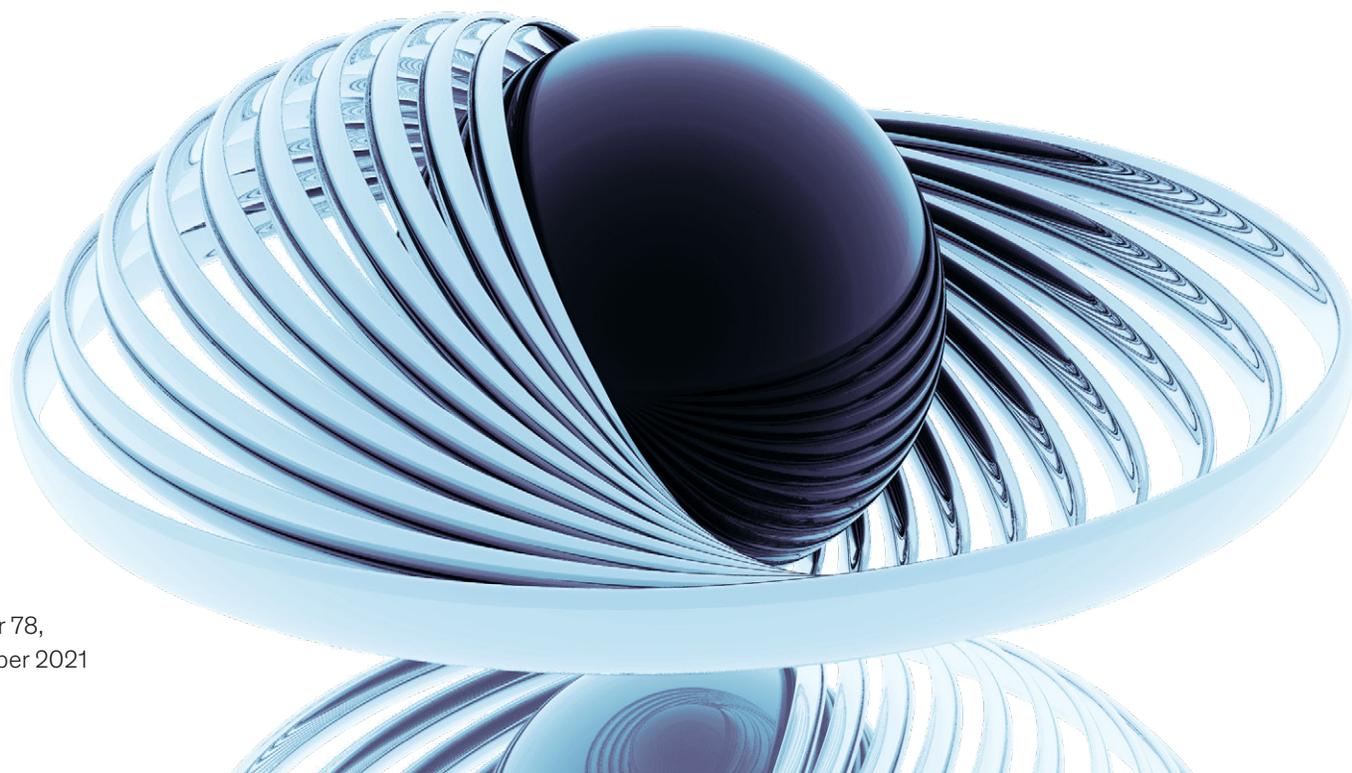


# McKinsey on Finance

Perspectives on corporate finance and strategy

## Valuation in emerging markets

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# Table of contents



## 2 Don't overthink your approach to valuation in emerging markets

The risks of investing in emerging markets are real, but it's not necessary to amplify them by adding an extra risk premium to the cost of capital. Standard valuation principles still apply. Here's why.

---



## 17 Sounding the alarm on system noise

Daniel Kahneman and Olivier Sibony, renowned experts in cognitive biases and decision making, explain how noise—or unwanted variability—clouds organizations' judgments, and what to do about it.

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## 8 Reports of corporates' demise have been greatly exaggerated

An analysis of 20 years of data on publicly traded companies and IPOs demonstrates that the drop-off in the number of listings is less steep than pundits would have you believe.

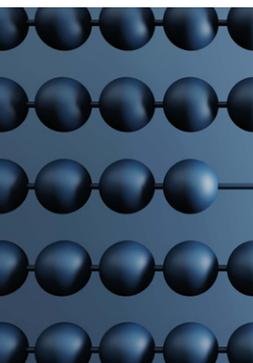
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## 24 Achieving win-win spin-offs

By acknowledging and addressing four factors relating to execution and operations, ParentCo can separate from SpinCo in a way that creates value for both.

---



## 13 Which metrics really drive total returns to shareholders?

McKinsey analysis of more than 2,200 large global companies reveals the importance of monitoring both economic-profit growth and revenue growth.

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## 28 Bias Busters: Taking the 'outside view'

Using a reference class can help executives gain much-needed perspective to inform their decision making.

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# Don't overthink your approach to valuation in emerging markets

The risks of investing in emerging markets are real, but it's not necessary to amplify them by adding an extra risk premium to the cost of capital. Standard valuation principles still apply. Here's why.

*by Paulo Guimaraes and Tim Koller*



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**There's no denying** the appeal of investing in emerging markets. Not only are emerging economies growing faster than developed ones but they also now account for 85.9 percent of the world's population and 57.5 percent of its GDP.<sup>1</sup>

But there's no sugarcoating the uncertainties, either. It's hard enough for business leaders to forecast cash flows accurately and estimate cost of capital amid fluctuations in foreign currency and potential increases in inflation, even when valuing companies that operate in traditional, developed economies. Emerging markets present additional risks—extreme economic contraction, for instance, or unexpected government actions such as asset appropriation. These risks vary by country and may affect different businesses in different ways.

Given these uncertainties, how should business leaders approach valuations in emerging markets as they consider making new investments or re-upping on existing ones?

Some academics, investment bankers, and industry practitioners believe it is necessary to incorporate an additional country risk premium in the cost of capital.<sup>2</sup> Our research and experience in the field suggest that would be a mistake. Business leaders can rely on the same valuation principles and approaches they would use to assess investments in developed markets. Tried-and-true valuation principles don't become any less valid in emerging markets. In fact, under high uncertainty, they can be even more essential.

### **The premium puzzle**

Since investing in emerging markets can be riskier than investing in developed ones, why not simply add a country risk premium to the discount rate to account for the circumstances? There are several reasons why this logic is flawed.

### **Risk is a relative concept**

First, consider that the very concept of risk is both relative and circumstance-dependent. Often, practitioners' added risk premium is based on the government's borrowing rate relative to a benchmark, such as the borrowing rates for the US government. But the riskiness of lending to a government may have little to do with the risk of investing in a business in that country. A company may have a cost of equity that is lower than the interest rate on the government debt in the country. Consider the riskiness of a consumer-packaged-goods (CPG) producer in an emerging market versus the government debt of that country. The CPG producer may experience a large drop in earnings during an economic crisis, but its earnings would likely spring back relatively quickly. And in contrast to the political environment facing banks and mining or energy companies, CPG businesses face little risk of appropriation by the government.

Another thing to note: it's not extraordinary for governments to default on debt or come close to doing so. Since 1990, Russia and Argentina have each defaulted, and Greece required bailout loans from the International Monetary Fund and European Central Bank multiple times. The cost of debt for some companies may also be lower than that of their government, as is the case in Brazil, where a number of companies' debt is rated investment grade while the government's is not.

Furthermore, it's illogical to apply the same risk premium across all industries within a given country. Between 2013 and 2018, returns on ten-year government bonds in Brazil were more volatile than those of the beverage company Companhia de Bebidas das Américas (Ambev) and less volatile than those of major Brazilian banks. Additionally, some companies, such as raw-materials exporters, might benefit from a currency devaluation while others, such as raw-materials importers, typically suffer when devaluations occur.

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<sup>1</sup> *World economic outlook: Managing divergent recoveries*, International Monetary Fund, April 2021, imf.org.

<sup>2</sup> Tom Keck, Eric Levengood, and Al Longfield, "Using discounted cash flow analysis in an international setting: A survey of issues in modeling the cost of capital," *Journal of Applied Corporate Finance*, 1998, Volume 11, Number 3, pp. 82–99, onlinelibrary.wiley.com.

### Premiums are often set too high

Additional country risk premiums are often set too high,<sup>3</sup> which can make good projects seem unattractive or lead to overcompensation when projecting future performance. Consider the valuation of a large Brazilian chemical company: using a local weighted average cost of capital (WACC) of 10 percent, an analyst reached an enterprise value of 4.0 to 4.5 times earnings before interest, taxes, depreciation, and amortization (EBITDA). A second analyst was asked to value the company and came to a similar figure—an EBITDA multiple of around 4.5—despite using a very high country risk premium of 11 percent on top of the WACC. The results were similar because the second analyst made performance assumptions that were far too aggressive: real sales growth of almost 10 percent per year and a return on invested capital (ROIC) increasing to 46 percent in the long term. Such long-term performance assumptions are unrealistic for a commodity-based, competitive industry such as chemicals.

In another, broader set of analyst forecasts from 2015 to 2018, 30 percent of industries were expected to achieve growth rates of more than 20 percent, while in the United States, only 5 percent were expected to achieve similar results. It's hard to imagine 30 percent of industries growing more than 20 percent per year.

### Actual performance is misrepresented

Our research also shows that there isn't much of a country risk premium built into the valuation of stocks in some emerging markets. If there were a substantial country risk premium, we'd expect price-to-earnings ratios (P/Es) to be much smaller than they are.

In Brazil, for instance, many valuations over the past decade have incorporated country risk

premiums of 3 to 5 percent, plus an inflation differential (compared with US companies) of about 2 to 3 percent. That leads to a cost of equity of 15 to 18 percent. If we assume a P/E of 13 times,<sup>4</sup> with some reasonable assumptions about cost of equity, marginal return on equity, and inflation,<sup>5</sup> one would have to believe that the businesses would need to grow at 8 percent to justify those valuations. But 8 percent real growth in perpetuity is clearly unrealistic.

Of course, these results are highly sensitive to small changes in some of the assumptions. The key point is that it's very difficult to reconcile current P/Es with a high country risk premium. The results are further borne out by an additional analysis we conducted, bridging the US S&P 500 Index to Brazil's Bovespa Index. These findings suggest that differences in multiples come almost exclusively from performance rather than additional country risk (Exhibit 1).

### The scenario-based solution

It's all too easy to underestimate the impact that even a small country risk premium has on valuations. Macro analyses can mask a wide variation in P/Es across economies. But that's where the scenario discounted-cash-flow (DCF) approach proves its mettle: it assesses risks based on company-specific factors and tests what the effects of those risks would mean to the business being valued.

At a minimum, business leaders should model two scenarios. The first should reflect cash flows that could develop under "business as usual" conditions—for instance, in the absence of major economic distress. The second should reflect cash flows that could develop if one or more emerging-market risks materialize.

<sup>3</sup> Ryan Davies, Marc Goedhart, and Tim Koller, "Avoiding a risk premium that unnecessarily kills your project," August 1, 2012, McKinsey.com.

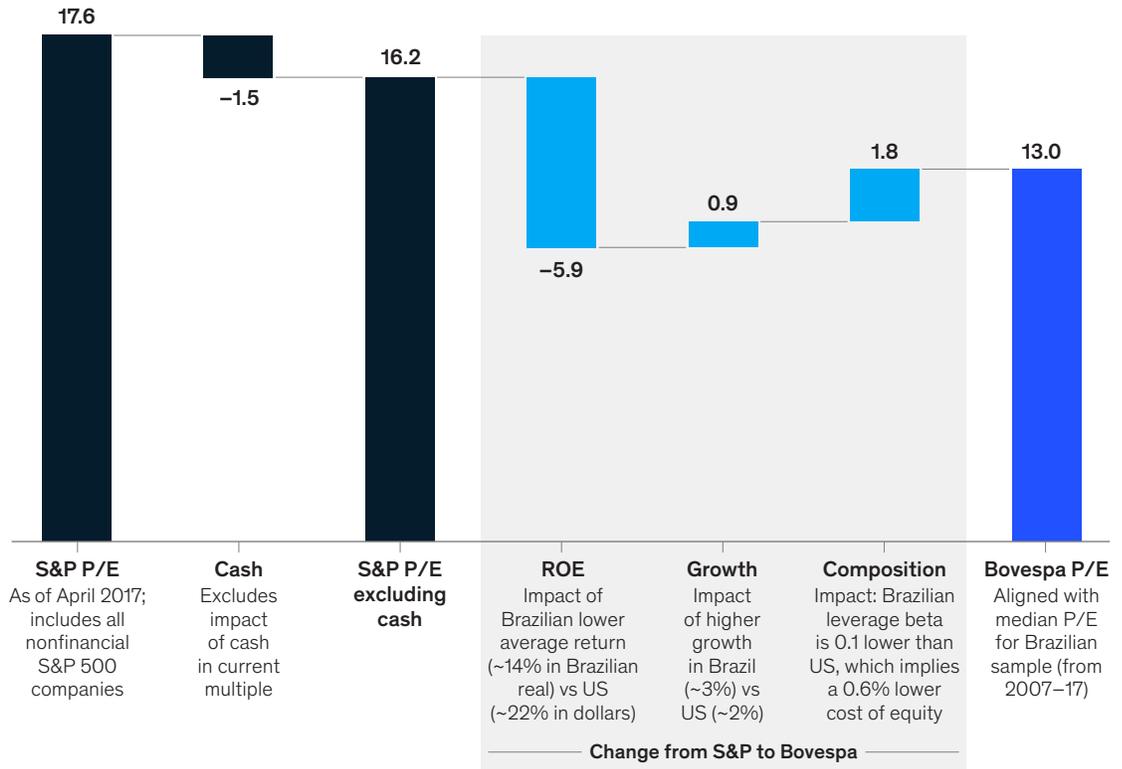
<sup>4</sup> From 2015 to 2018, the P/E for the major Brazilian market index has been in the range of 10 to 17 times.

<sup>5</sup> For purposes of this example, we assume a cost of equity of 15 percent, a marginal return on equity of 20 percent (above historical averages), and 4 percent inflation (based on 2 percent in the United States and two percentage points higher inflation in Brazil). If, on the other hand, we eliminate the additional country risk premium, the results make more sense. In 2016, for example, the P/E was about 13 times. Assuming 3.5 percent long-term real growth plus 4 percent inflation and a 14 percent return on equity, we calculate a nominal cost of equity of about 11 percent. Subtracting inflation at 4 percent gives us a 7 percent real cost of equity—not very different from the real cost of equity in the United States.

Exhibit 1

**The difference between Brazilian and US multiples can be explained by performance factors; a country risk premium doesn't seem to play a role.**

Bridge from S&P Index to Bovespa Index, price-to-earnings (P/E) ratio, multiple



Note: Figures may not sum to total, because of rounding.  
Source: S&P Global; McKinsey analysis

Consider the valuation of a European factory and that of an emerging-market factory; both have a similar outlook except for the emerging-market risk. An analysis shows that the cash flows for the European factory could grow steadily at 3 percent per year into perpetuity. By contrast, the cash flows for the factory in the emerging market could grow similarly under a business-as-usual scenario, but there is a 25 percent probability of economic

distress, which could result in cash flows that are 55 percent lower into perpetuity. The emerging-market risk is taken into account—not in the cost of capital, but in the lower expected value of future cash flows from weighting both scenarios by their assumed probabilities. The resulting value of the emerging-market factory (€1,917) is clearly below the value of the European factory (€2,222), using a WACC of 7.5 percent (Exhibit 2).

Exhibit 2

**A scenario discounted-cash-flow approach captures ‘business as usual’ and ‘economic distressed’ outlooks.**

**Net present value (NPV) for ‘business as usual’ and ‘economic distressed’ scenarios, identical facilities**

Scenario approach	European market						Emerging market					
	Probability	Scenario	Year 1	2	3	4...	Probability	Scenario	Year 1	2	3	4...
Scenario approach	Cash flows in perpetuity <sup>1</sup>						Cash flows in perpetuity <sup>2</sup>					
	100%	As usual	100	103	106	109	75%	As usual	100	103	106	109
	0%	Distressed	—	—	—	—	25%	Distressed	45	46	48	49
	Expected cash flows						Expected cash flows					
			100	103	106	109			86	89	92	94
	Cost of capital					7.5%	Cost of capital					7.5%
	Net present value					€2,222	Net present value (86% of European NPV)					€1,917

Country-risk-premium approach	European market						Emerging market					
	Scenario	Year 1	2	3	4...	Scenario	Year 1	2	3	4...		
Country-risk-premium approach	Cash flows in perpetuity <sup>1</sup>						Cash flows in perpetuity <sup>2</sup>					
	As usual	100	103	106	109	As usual	100	103	106	109		
	Cost of capital					7.5%	Cost of capital					7.5%
	NPV					€2,222	Country risk premium					0.7%
							Adjusted cost of capital					8.2%
							NPV (86% of European NPV)					€1,917

<sup>1</sup>Assuming perpetuity cash-flow growth of 3%.  
<sup>2</sup>Assuming perpetuity cash-flow growth of 3% and recovery under duress of 45% of cash flows "as usual."  
 Source: Tim Koller, Marc Goedhart, and David Wessels, *Valuation: Measuring and Managing the Value of Companies*, Wiley, June 2020

Exploring different scenarios forces managers to discuss emerging-market risks and their effect on cash flows under realistically conceivable circumstances, thereby gaining more insights than they would from a simple, arbitrary addition to the discount rate. In this way, managers can identify the specific factors with the largest impact on value and plan to mitigate these risks.

**Tying it all together**

Scenario analyses are an essential part of valuing any investment in an emerging market, but they are only part of the story. Business leaders operating in

emerging markets face unique challenges in estimating the cost of equity, the after-tax cost of debt, and the proper cost of capital, which should generally be close to a global cost of capital adjusted for local inflation and capital structure.

Some critical information and data (for example, in estimating betas) may be missing. Business leaders must be flexible as they assemble the information that is available, piece by piece. And they must bear in mind that the cost of capital in an emerging-market valuation may change, based on evolving inflation expectations, changes in a company's capital structure and cost of debt, or foreseeable

reforms in the tax system. In Argentina during the economic and monetary crisis of 2002, for instance, the short-term inflation rate was 30 percent. This would not have been a reasonable rate for estimating the cost of capital long term, because such a crisis should not have been expected to last forever. In such cases, it is best to estimate the cost of capital year to year, following an underlying set of basic monetary assumptions.

Ultimately, the best practice for practitioners conducting valuations of emerging-market investments is to triangulate the results of their scenario analyses with a comparable, forward-looking multiples approach and a DCF using a realistic country risk premium, grounded in the country's historical probability of economic crises and the effect of those crises on that specific

industry. For instance, our analyses revealed that even severe turmoil rarely leads to a loss of all cash flows for consumer-goods companies in one emerging-market economy, which suggests a country risk premium of 1 to 2 percent is more realistic than common estimates of 3 to 5 percent, or higher.

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To value companies in emerging markets, it's best to stick with principles that apply in developed and emerging economies alike. In particular, adding an extra country risk premium to the cost of capital doesn't add insight; it obscures it. There's uncertainty—and opportunity—enough in emerging markets without adding guesswork to the equation.

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# Reports of corporates' demise have been greatly exaggerated

An analysis of 20 years of data on publicly traded companies and IPOs demonstrates that the drop-off in the number of listings is less steep than pundits would have you believe.

*by Vartika Gupta, Tim Koller, and Peter Stumpner*



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**The number of public-company listings** in the United States peaked in the mid-1990s, at nearly 6,000, but that number has fallen by about half over the past 20 years.<sup>1</sup> The number of IPOs has also gone down sharply in this same period.<sup>2</sup> A chief worry among some pundits<sup>3</sup> is that drop-offs in both areas may limit the playing field for smaller, less-sophisticated investors and prevent them from putting their money behind big ideas that may create big value for the markets and for society.<sup>4</sup> Our research shows, however, that these trends are overstated. The decline is not as steep as pundits suggest, and the shifts simply reflect the natural ebb and flow of markets and corporate business strategies.

Our examination of close to 10,000 public-company listings and IPOs in the United States over the past two decades reveals that the drop-off in the number of listed public companies is primarily the result of changing dynamics in several key sectors: banking, industrials, and technology. What's more, the net decline can be mostly attributed to exits that occurred between 2001 and 2010—and most of those exiting companies had been acquired.<sup>5</sup> The data also show that industry consolidation

contributed to a decline in IPOs between 2001 and 2010, but the numbers have stabilized since then.<sup>6</sup>

### **A change in the number of public companies**

According to our analysis, the number of public companies listed in the United States dropped from about 5,500 in 2000 to about 4,000 in 2020. One interesting trend, however, is that there were more company exits during the first decade than the latter one: between 2001 and 2010, about 3,300 companies exited the market while 1,800 companies entered. (It's worth noting that the dot-com bubble and the credit crisis occurred during this period.) By contrast, between 2011 and 2020, corporate exits and new market entries were about even at 2,100 (Exhibit 1).

A closer look at the data shows that banks (diversified financials), industrial companies, and technology firms (hardware and semiconductors) accounted for much of the decline in the number of public companies. Between 2001 and 2010, these sectors experienced twice as many exits as new entrants (Exhibit 2). The US banking system,

**According to our analysis, the number of public companies listed in the United States dropped from about 5,500 in 2000 to about 4,000 in 2020.**

<sup>1</sup> Ruchir Sharma, "The rescues ruining capitalism," *Wall Street Journal*, July 24, 2020, [wsj.com](https://www.wsj.com).

<sup>2</sup> Paul Smith, "Shrinking public markets limit the playing field for the average investors," CNBC, January 4, 2019, [cnbc.com](https://www.cnbc.com).

<sup>3</sup> Frank Partnoy, "The death of the IPO," *Atlantic*, November 2018, [theatlantic.com](https://www.theatlantic.com).

<sup>4</sup> "Taking stock: Catching up with Nasdaq CEO Adena Friedman," *McKinsey Quarterly*, February 8, 2021, [McKinsey.com](https://www.mckinsey.com).

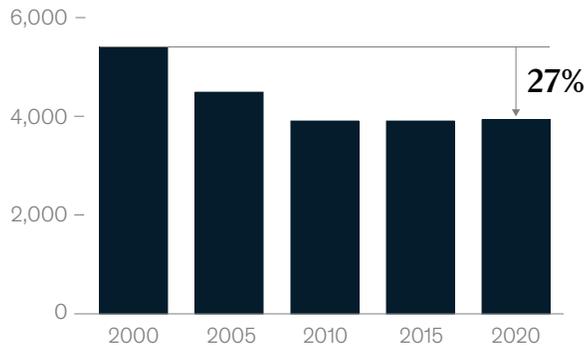
<sup>5</sup> "Exits" refer to companies that have delisted because they were acquired, filed for bankruptcy, no longer meet listing requirements, or became private.

<sup>6</sup> The recent rise in the number of special-purpose acquisition companies (SPACs) may also be a factor, although it's too early to assess the full impact. See Kurt Chauviere, Alastair Green, and Tao Tan, "Earning the premium: A recipe for long-term SPAC success," September 23, 2020, [McKinsey.com](https://www.mckinsey.com).

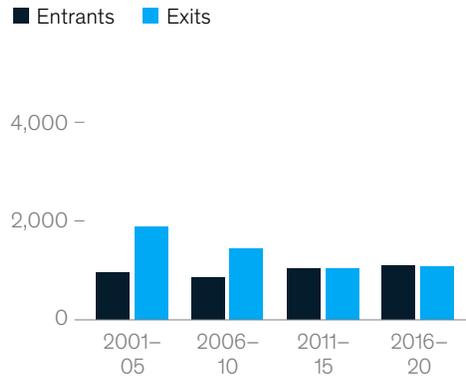
Exhibit 1

**The number of listed public companies in the United States has declined over the past 20 years, but activity has remained stable since 2010.**

**US public companies**



**Activity in US public companies**

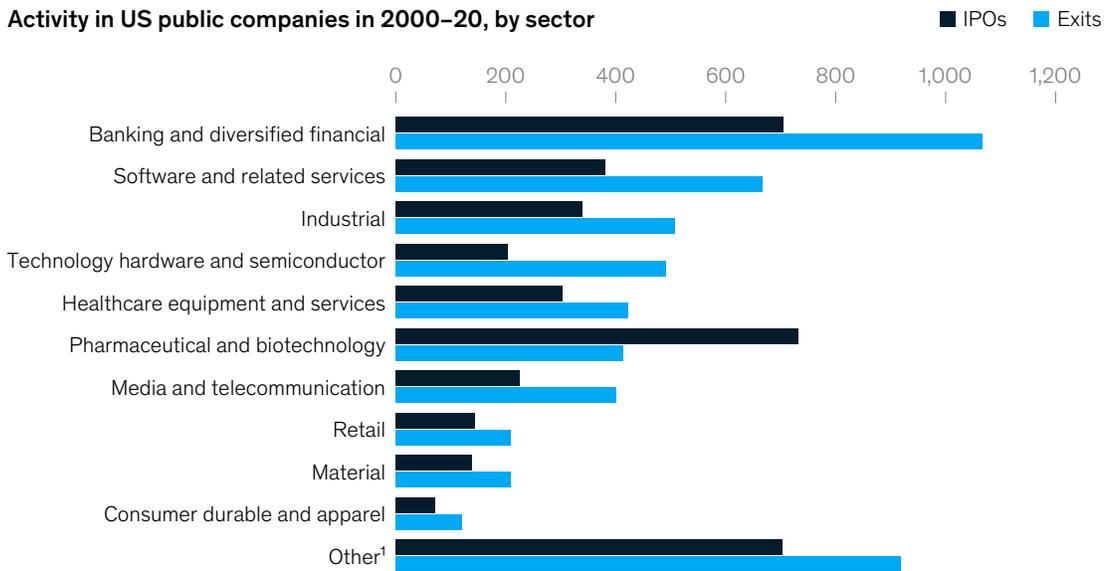


Source: S&P Global; Corporate Performance Analytics by McKinsey

Exhibit 2

**Much of the drop-off in US public-company listings in the past 20 years can be attributed to changing dynamics in several key sectors.**

**Activity in US public companies in 2000–20, by sector**



<sup>1</sup>Includes energy, insurance, household and personal products, real estate, services, and utilities.

Source: S&P Global; Corporate Performance Analytics by McKinsey

for instance, which had long been one of the most fragmented in the world because of decades-long laws that prevented cross-state banking, has been consolidating over time as regulations have changed. At the same time, we've seen more IPOs from innovative payment and financial-technology companies that, while fewer in number, boast sizable market capitalizations. These types of IPOs can present new opportunities for investors.

A double-click on the exit data reveals that about 95 percent of the exiting companies in our research base had been acquired (Exhibit 3). Also of note, the only companies that increased their representation during the 20-year period we studied were those in pharmaceuticals and biotechnology. Between 2011 and 2020, there were more than twice as many new corporate entrants as exits in these sectors, which is perhaps not surprising when you consider

that start-ups are now doing much of the research on new drugs—with help from venture-capital funds, of course. The start-up companies that succeed, and then go public, provide opportunities for other, public investors.

### A change in the number of IPOs

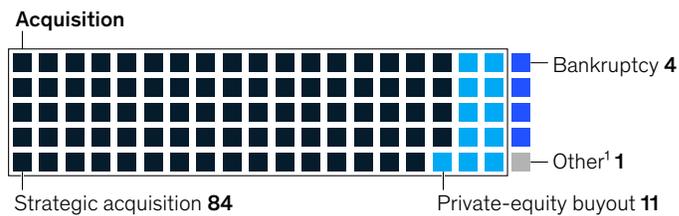
We also analyzed the change in the number of IPOs over the 20-year period. Just recently, there has been a surge in IPOs, which is perhaps a reflection of the response and recovery from the global COVID-19 pandemic. More than 400 have been filed so far in 2021, which already exceeds the total number of IPOs in 2020.

Recent surge aside, the number of IPOs did decline between 2001 and 2010—perhaps due to the cost, time requirements, and complex disclosures

Exhibit 3

## Of the US public-company exits in the past 20 years, 95 percent were the result of acquisition.

US public-company exits, 2000–20, by reason, %

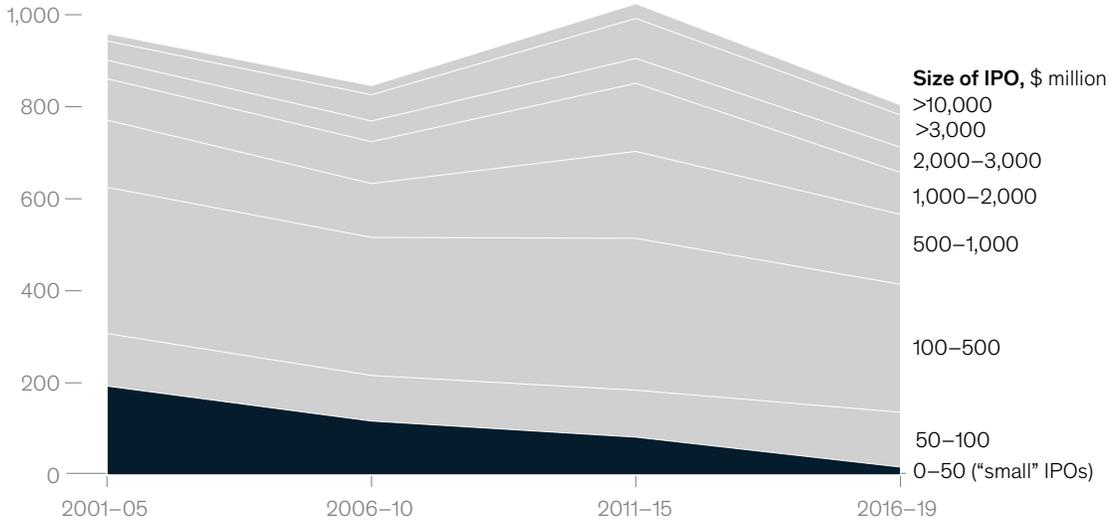


<sup>1</sup>Includes voluntary and involuntary delistings.  
Source: S&P Global; Corporate Performance Analytics by McKinsey

Exhibit 4

**There are fewer ‘small’ IPOs now.**

**IPOs, by size**



Note: Figures are adjusted for inflation.  
Source: S&P Global; Corporate Performance Analytics by McKinsey

required for companies to go public—but it has remained relatively stable since then, with about 200 IPOs filed each year.<sup>7</sup>

IPOs are also getting larger. Between 2001 and 2010, around 15 percent of all IPOs filed were under \$50 million; that number was only 5 percent between 2011 and 2020 (Exhibit 4).

The concerns about the decline in the number of listed companies appear to be unfounded. Trend lines can change, of course, and the fact that IPOs are getting larger does signal that some of the early value capture right now is by private investors. But for now, the public markets are robust and continue to provide opportunities for all kinds of investors.

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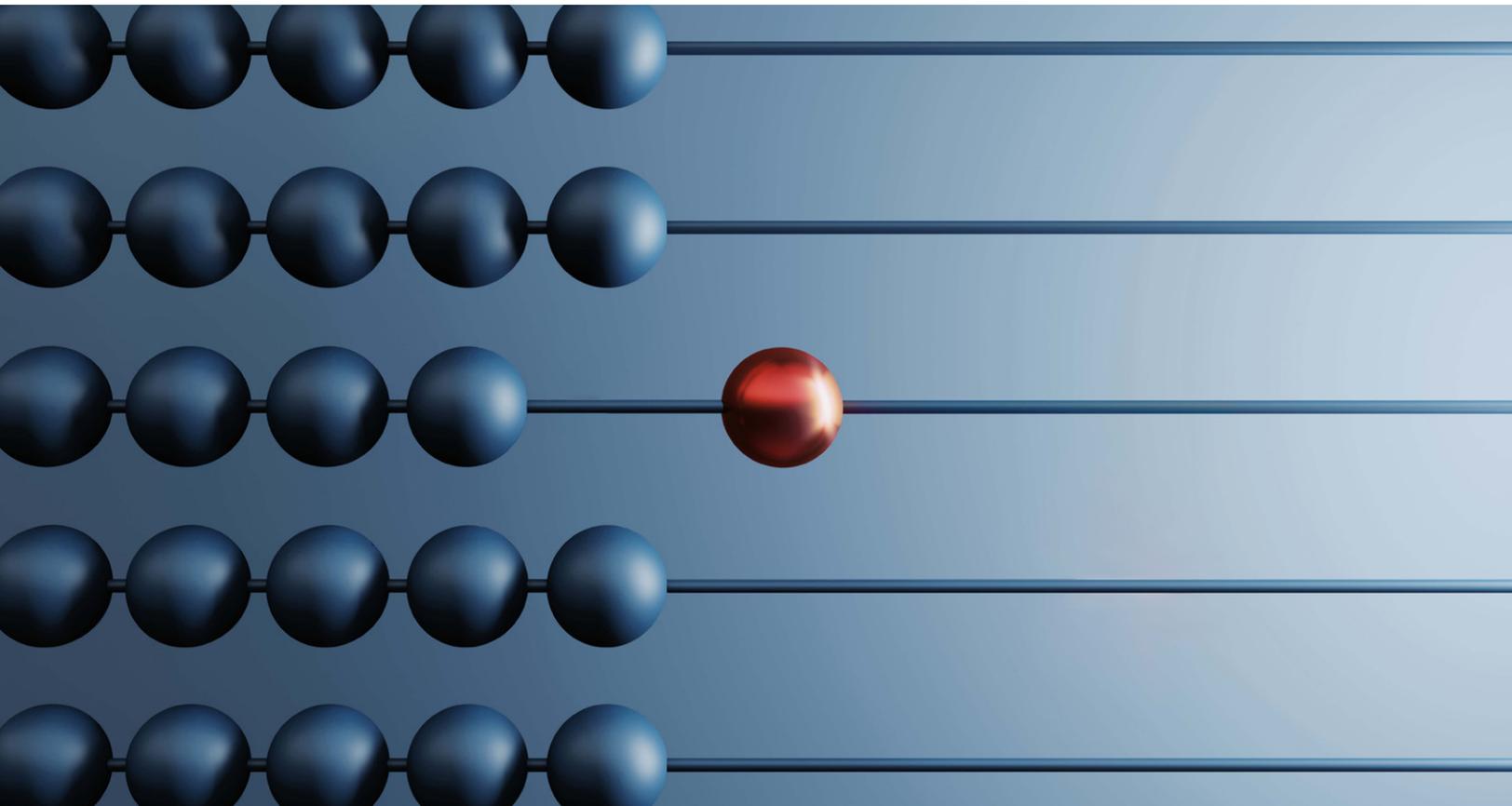
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<sup>7</sup> This excludes periods of financial recession, such as 2008–09.

# Which metrics *really* drive total returns to shareholders?

McKinsey analysis of more than 2,200 large global companies reveals the importance of monitoring both economic-profit growth and revenue growth.

*by Vartika Gupta, Tim Koller, and Peter Stumpner*



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**Many executives, analysts, and pundits** continue to focus on earnings per share (EPS) as a major driver of returns to shareholders and, thus, a primary indicator of corporate performance. Our historical and updated analyses point to a better metric—economic profit (EP), or a company's total profit after the cost of capital is subtracted.

EP is linked directly to a company's return on invested capital (ROIC) and revenue growth, both of which are fundamental drivers of value creation.<sup>1</sup> When return on capital exceeds the weighted average cost of capital, EP will be positive, and value will be created for shareholders. By contrast,

some actions that boost EPS (stock buybacks, for instance) may not ultimately create value for shareholders—hence the limitations of that metric.

McKinsey first highlighted the relationship between EP and total returns to shareholders (TRS) several years ago in its discussion of the power curve and the ten levers that explain most of the rise and fall in corporate performance.<sup>2</sup> Now, looking back at that research and broadening it to include data from between 2015 and 2019, we see an even stronger correlation between EP and TRS. And when we add revenue and margin growth to our analysis, the correlations get stronger still (Exhibit 1).

Exhibit 1

## Economic profit is more highly correlated with returns to shareholders than earnings per share.

### Regression models

y	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	Correlation, %	R <sup>2</sup> , %
TRS <sup>1</sup>	Economic profit (EP) growth	Revenue growth	EP margin delta	66	43
TRS	EP growth	Revenue growth		58	33
TRS	Earnings per share (EPS) growth	Revenue growth	Net margin delta	56	31
TRS	EPS growth	Revenue growth		54	29
TRS	EP growth			45	21
TRS	EPS growth			34	12

Note: Based on top 300 US companies by market capitalization in 2019 (excluding financial sectors); research base comprises data from 2010–19; excludes companies with negative EP in 2010, companies with a decline in EP from 2010–19, as well as Alphabet, Amazon, Apple, Facebook, Microsoft, and Tesla.

<sup>1</sup>Total returns to shareholders.

Source: S&P Global; Corporate Performance Analytics by McKinsey

<sup>1</sup> Marc Goedhart, Tim Koller, and David Wessels, *Valuation: Measuring and Managing the Value of Companies*, seventh edition, Hoboken, NJ: John Wiley & Sons, June 2020.

<sup>2</sup> Chris Bradley, Martin Hirt, and Sven Smit, *Strategy Beyond the Hockey Stick: People, Probabilities, and Big Moves to Beat the Odds*, first edition, Hoboken, NJ: John Wiley & Sons, February 2018.

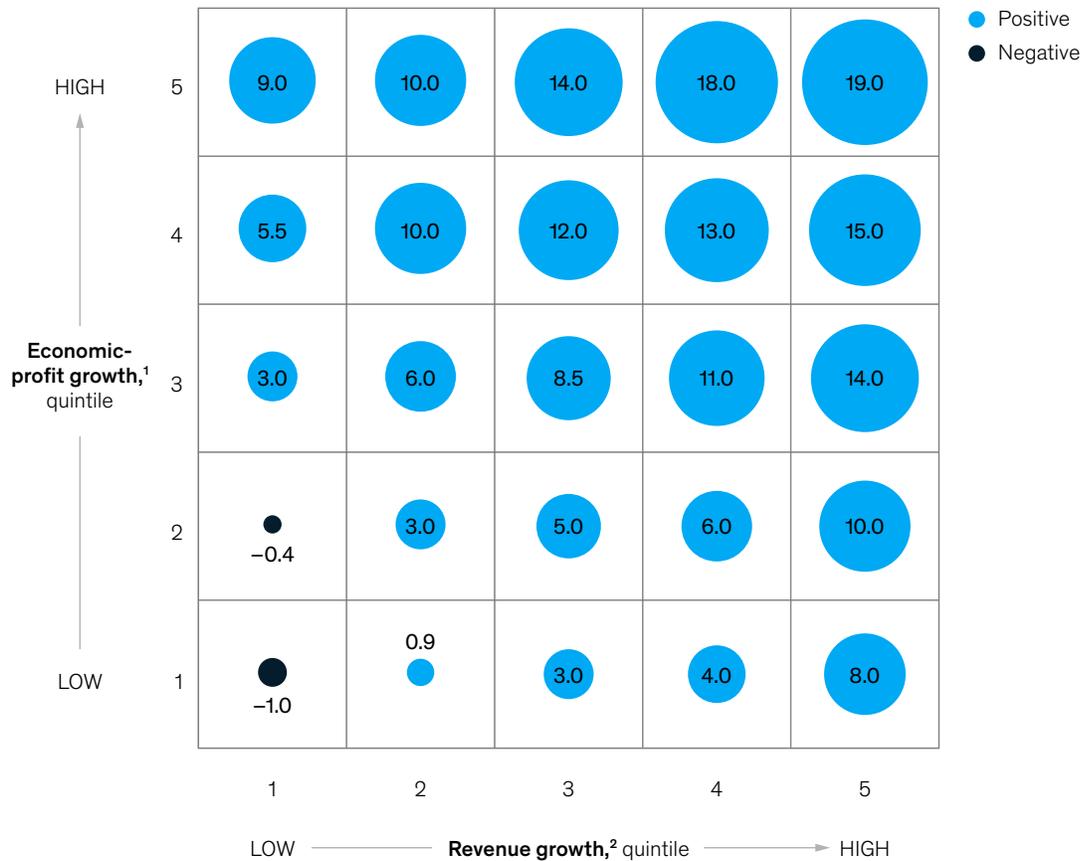
The research also sheds light on the importance of revenue growth in generating TRS, regardless of a company's starting point. For instance, companies in our highest quintile for both EP and revenue growth generated TRS at 19 percent. But even the companies in our lowest quintiles for EP and revenue growth still generated TRS that was mostly positive (Exhibit 2).

The importance of both metrics is clear; but it's also worth noting that *how* you manage EP and revenue growth matters. In the long term, it doesn't pay to increase EP at the expense of revenue growth. For instance, a company that cuts back on R&D expenses to improve its margins in the short term could also end up reducing its ability to launch new products and services—and new revenue streams. In our

Exhibit 2

**Higher economic-profit growth plus higher revenue growth generates higher returns to shareholders.**

Total returns to shareholders, %



<sup>1</sup>Data are from 2005–09 and 2015–19; economic profit has been scaled relative to starting size. Figures have been rounded up.  
<sup>2</sup>Based on top 2,258 US companies by market capitalization in 2019 (excluding financial sectors). The research base comprises data for 2005–19. It excludes companies with negative average economic profit in 2005–09.  
 Source: S&P Global; Corporate Performance Analytics by McKinsey

experience, companies that focus on long-term growth and EP tend to create more value.

Overall, our findings reflect the established finance theory: if executives are doing the right things strategically, they will see EPS, EP, and TRS all rise. However, EPS may also grow even when no value is created—for instance, in the case of an acquisition in which the purchase price exceeds the intrinsic value of the deal.

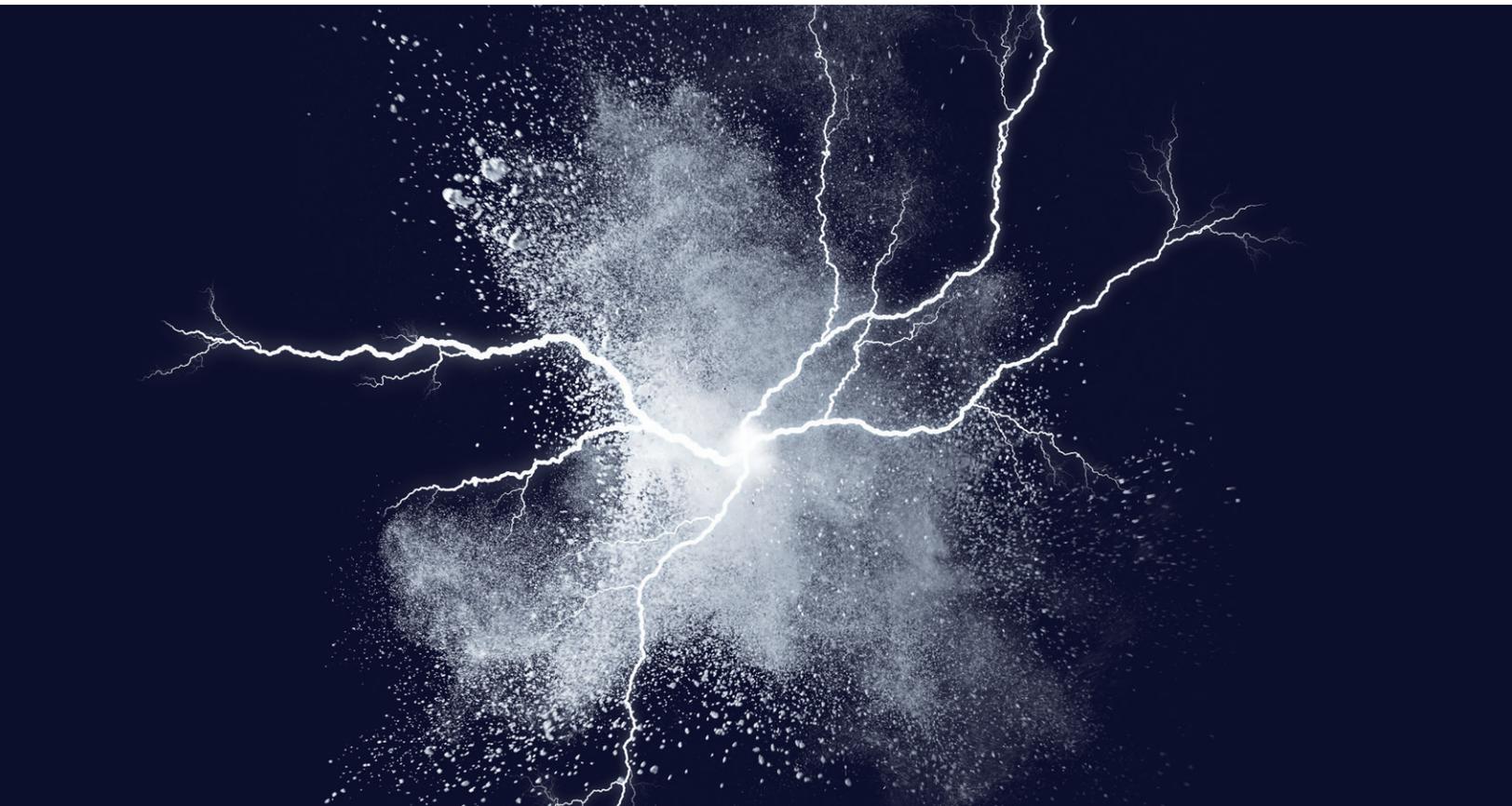
By contrast, EP is driven by returns on invested capital, revenues, and the opportunity cost of capital. So unlike EPS, it will increase only when value is created. Especially when considered alongside revenue growth, EP explains returns to shareholders very well—and better than EPS.

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# Sounding the alarm on system noise

Daniel Kahneman and Olivier Sibony, renowned experts in cognitive biases and decision making, explain how noise—or unwanted variability—clouds organizations' judgments, and what to do about it.



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**By now, most people** understand the ways in which biases can creep into important decisions. Most are much less aware, however, of how much noise can affect their choice making, according to psychology and strategy experts Daniel Kahneman and Olivier Sibony. In this case, noise refers not to the clatter in the room but to the high variability in inputs and cognitive processing that people must contend with when making singular and collective judgments.

The concept is less well-known, in part because there has been much more research on bias than on noise—something Kahneman and Sibony are seeking to change with their recent book, *Noise: A Flaw in Human Judgment* (Hachette Book Group, May 2021), coauthored with Harvard professor Cass R. Sunstein. In this edited conversation with McKinsey's Julia Sperling-Magro and Roberta Fusaro, Kahneman and Sibony explain what noise is, how it relates to bias, and what people can do about it.

**McKinsey:** You both have researched and written so much about decision making and cognitive biases. What brought you to the topic of noise? And why now?

**Daniel Kahneman:** I've been working on errors of judgment for most of my career, more than 50 years, and most of that time, I've been studying biases and how they lead to errors in judgment. But about seven years ago, I encountered another type of error, which is noise. It's something I hadn't thought about earlier—neither had a lot of other people. So that became a topic of thinking and, ultimately, of the book. As to the question, "Why now?" I would say the book is, in a way, premature. The normal sequence would be, you have an idea, you spend 15 years researching, teaching, and living the topic. Given my age [87], we didn't have 15 years to wait [laughs], so the book came out a bit early—it's still green, not ripe, but that's the best that we could do [see sidebar, "Making Noise: A closer look at the creative process"].

**Olivier Sibony:** In some of the work I was doing with companies to address the problem of bias, it struck me quite often that the effect of bias is not actually predictable, as we would normally assume. It is often something much more random, and when Danny started talking about noise, I realized that we were talking about the same thing.

## Identifying unwanted variability

**McKinsey:** How do you both define "noise"?

**Olivier Sibony:** Noise is the unwanted variability in professional judgments. The inclusion of "unwanted" in the definition is very important, because sometimes variability in judgments is not a problem; sometimes it's even desirable. But not when it involves a professional judgment. The obvious example would be a doctor's diagnosis. If two doctors give you two different diagnoses, at least one of them must be wrong. That is a judgment where variability is not desirable. There is a correct answer, and you would want these two people to have the same answer. When you don't have the same answer to something where you'd want the same answer, that's noise.

**McKinsey:** What differentiates noise from bias?

**Daniel Kahneman:** Put simply, bias is the average error in judgments. If you look at many judgments, and errors in those judgments all follow in the same direction, that is bias. By contrast, noise is the variability of error. If you look at many judgments, and the errors in those judgments follow in many different directions, that is noise.

**Olivier Sibony:** Here's a forecasting example to make it more concrete. Say we are planning how long it will take to redecorate our kitchen. We can expect that all of us will be too optimistic; all of us will underestimate the time it will take to finish the renovation. But even though we're all talking about the same kitchen, none of us will have the exact

## Making Noise: A closer look at the creative process

**McKinsey:** One of the taglines for the book is, “What happens when a psychologist, a business professor, and a legal scholar team up?” Tell us, what did happen?

**Daniel Kahneman:** The idea of writing the book came up in conversations between Olivier and me and another friend of ours, Dan Lovallo. Olivier, who lives in Paris, very generously came to New York to talk with me about the possibilities. We would spend a few days together every few weeks, and at the time I warned him very firmly that, given my impossible character, there would never be a book [laughs]. But he kept coming, and at some point, Cass Sunstein wanted to join us, and that made me more optimistic that there would be a book. We worked with my agent, who had helped me to publish *Thinking, Fast and Slow*, and he very quickly—before we could change our minds—organized advances and auctions and lots of things so that we lost control of the process.

**McKinsey:** I'm now imagining these meetings you and Olivier had in New York. Did you sit down over a cup of tea or coffee, or did the creative process involve a whole bunch of flip charts?

**Olivier Sibony:** It was more coffee than tea, no flip charts. We read lots of white papers and exchanged lots of ideas. We had a lot of good meals when we could still go to restaurants. Danny was kind enough to come to Paris quite a few times. The process of writing the book was fun. We didn't expect it to take as long as it did. We would have debates. Danny would say, suddenly, “Everything we've done is completely wrong, and we need to start from scratch.” And every time, of course, he would be right to some degree. We didn't need to start *everything* from scratch, but it usually meant that something needed to be improved. Danny does this quite a bit—he is incredibly demanding of himself. This degree of self-criticism on his part, I think, is what helps drive his ideas forward.

**Daniel Kahneman:** The virus forced us away from a fairly inefficient way of collaborating, where we would travel to New York or Paris to meet for a few days, and toward a much more efficient system where we Zoomed for an hour or two a day, for a whole year. That was one enabling condition for the book. The other is Olivier's character. He is incredibly patient. I mean, working with me has always been difficult. All my collaborators have complained. But I think that Olivier had more reason than many others to complain, and he was imperturbable.

**Olivier Sibony:** Danny is incredibly hardworking. He is now 87, and he's been working harder than me at this book and was feeling guilty when he wasn't working on it. I can only wish to have that level of energy when I'm 67, let alone 87 [laughs].

same estimate of how long the project will take. The average error, whereby we underestimate the time, will be the bias in our forecast. The variability in those forecasts is the noise.

**McKinsey:** Where is noise commonly found?

**Daniel Kahneman:** The noise we're talking about in the book is “system noise,” or unwanted variability within a system of judgments. A good example is the judicial system. Judges should be interchangeable. They should give the identical sentence in the identical case. When they don't, that is system noise. We found the same dynamics in medicine,

with underwriters in insurance, and in many other functions.

There can also be noise within an individual. It happens, for instance, when people are presented with the same problem twice and they don't recognize that it's the same problem, so they give different answers. Or it happens when people see the same problem under different conditions—the conditions shouldn't matter, but they do. The sentences that judges hand down, for instance, can vary with the outside temperature. So it's worse to be a defendant on hot days.

## Underestimating noise levels

**McKinsey:** Did one system, function, or industry surprise you as being particularly noisy?

**Olivier Sibony:** The most striking examples, to me, are in performance reviews. The research shows that when you evaluate someone's performance, only about one-quarter of the rating is related to actual performance. The other three-quarters are related to noise. It can be "level noise," which is that some raters are, on average, more generous than others. It can be "occasion noise," reflecting the fact that the evaluator may be in a better disposition today than on other days. And it can be the idiosyncratic response of each person to another person, of a rater to a "ratee." When you take all those things together, about three-quarters of a performance rating is based, in fact, on pure noise.

Outside the business world, the example that struck me the most is in the world of forensics and fingerprinting. We have been taught that

identification by fingerprints is infallible so long as you follow the right procedures for capturing and analyzing them. In fact, it's not. It's a judgment. And, like all judgments, it is subject to noise. There is less noise in fingerprinting than in performance ratings, of course, but where we would expect zero noise, there actually is some. Where we expect some noise, as in a performance rating, there is a lot. The bottom line, as we've put it in the book, is wherever there is judgment, there is noise, and probably more of it than you think.

**McKinsey:** How can you measure the level of noise in an organization?

**Olivier Sibony:** You do what we've come to call a "noise audit." You give the same problem to a lot of different people, and you measure the differences in their responses. For example, we presented some of our findings to an investment firm. Senior leaders there were interested in finding out whether there was noise among their analysts. They designed a case. They said, "Here is a company,

**'The research shows that when you evaluate someone's performance, only about one-quarter of the rating is related to actual performance. The other three-quarters are related to noise.'**

—Olivier Sibony

here is its P&L, here is its cash-flow statement.” They gave all that information to their analysts, who are supposed to be applying the same methods and the same techniques to value all the companies that they are looking at. They gave the same set of data to all their analysts and found that, on average, [between any two analysts] you would get a 44 percent difference in their evaluations. Leaders at the investment firm had no idea that the level of variability would be this large—and this is a common response. The degree of variability in judgment between people is always much greater than you expect.

**McKinsey:** How do people react when they get played back those results?

**Daniel Kahneman:** They tend to be surprised, and they think, “We really should do something about it.” But unless there is a lot of energy behind this, nothing happens. In fact, many organizations have information that there is a noise problem, but they don’t want to look at it—because it makes people look bad and because they don’t quite know how to intervene.

**Olivier Sibony:** The way that most companies produce judgments actually suppresses their ability to recognize noise and does not necessarily improve the quality of their judgments. If the three of us write down what we think is going to be the rate of inflation next year, we’re going to have very different answers. But if Julia speaks first and says, “Here is my assessment, and here’s why,” and Julia is our boss—well, we’re going to gradually converge to Julia’s answer. Maybe not completely, but we’re going to hesitate to voice the full extent of the disagreement that we have. This is not far removed from the way most companies produce judgments.

**Daniel Kahneman:** In principle, when companies hold case conferences in which people gather to discuss a particular problem, this would be an ideal setup for a noise audit. But for it to work, the case material would need to be viewed independently by all the participants, and each would need to make a judgment on the material independent from all the others. The case conference could then be a forum

for comparing those judgments. As it typically happens, the case is prepared by one person who provides a focus for agreement for the others. There is a wasted opportunity here to discover the amount of noise and constructively find ways to reduce it.

## Noise reduction through decision hygiene

**McKinsey:** In the book, you talk about “decision hygiene” as a way to reduce noise. What is it?

**Olivier Sibony:** Whenever you talk to people in organizations about reducing errors, they immediately jump to the idea of identifying their biases and how to fight them. If, for instance, your projects are always behind schedule because you are always too optimistic about deadlines, that’s something you should address. But in most decisions, there probably isn’t such an obvious directional error. It’s likely that you are going to find all kinds of different errors pulling and pushing in different directions. That’s why you need to look at it as noise.

Decision hygiene is a set of specific procedures for reducing noise. We call it hygiene because it is a form of prevention, not a remedy to an identified problem. As with other forms of hygiene, it can be a little bit thankless. You never get a pat on the back saying, “Well done washing your hands today, the disease you did not catch is the flu.” Likewise, you will never know which bias or error you averted by applying decision hygiene. It just needs to become second nature.

**McKinsey:** What are some examples of decision hygiene?

**Olivier Sibony:** One principle that Danny mentioned, when he talked about case conferences, is to aggregate multiple independent judgments. Whenever you have different people making judgments, rather than assign the judgment to one person or gathering three people to talk about it around the table, get them to make their judgments independently and take the average of that. Or



**Daniel Kahneman**



**Olivier Sibony**

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use some other variation on that theme. But essentially preserve the independence of people's judgments before you aggregate them. That's a big tool.

Another thing is to remember that competence matters. Some people are going to be better than others at any judgment. In medicine, for instance, some diagnosticians are better than others. If you can pick the better people, that helps. The better people are going to be more accurate; they are going to be less biased but they're also going to be less noisy. There is going to be less random error in their judgments.

Then you get to slightly less obvious principles. One thing that struck us, for instance, is that how you define the scale on which a judgment is made makes a huge difference in the amount of noise you see. If you replace an absolute scale with a relative scale, you can eliminate a very big chunk of the noise. Think of performance evaluations again. Saying that someone is a "two" or a "four" on a performance-rating grid—even when you have the definition of what those ratings mean—remains fairly subjective, because what "an outstanding performer" or "a great relationship skill" means to you is not necessarily the same thing that it means to me. But if you ask, "Are Julia's relationship skills better

than those of Claudia?" that's a question I can answer if I know both Julia and Claudia. And my answers are probably going to be very similar to yours. Relative judgments tend to be less noisy than absolute ones.

And there is another approach to noise reduction: using algorithms or rules of some kind, or artificial intelligence, to replace human judgment. Wherever there is judgment there is noise, but the corollary of that is wherever you want to get rid of noise, you need to take away the human element of the judgment. The beauty of algorithms is that they will do that. They will eliminate the noise. There will be no mood, no temperature, no difference between your judgments and my judgments. The machine will churn out the same judgments so long as the algorithm doesn't change.

The question is, could you inadvertently introduce some systematic bias into your decision making by using and training algorithms in a way that may not be perfect and where the algorithms themselves may be the product of biased human judgments? It's a very serious issue. But we don't think it's an issue that should prompt people to throw the algorithm baby out with the biased bathwater. The answer is not to reject all algorithms; it is to make sure algorithms are not biased.

## Reducing room for biases

**McKinsey:** Will applying decision hygiene help an organization reduce bias as well as noise?

**Daniel Kahneman:** Almost certainly, yes, you will reduce bias if you reduce noise. One of the origins of bias is that people tend to jump to conclusions, and they reach those conclusions early, based on very little information. They find information that confirms their existing opinions, and they look for information in a selective way. If you implement a decision-hygiene procedure, you break that pattern and prompt people to view the problem as separate subproblems that can be looked at factually, without intuition, or with minimal intuitive output and input. If decision-hygiene procedures are followed, you have less room for biases in the independent judgment.

**McKinsey:** As an organizational leader, how would I go about thinking about investing in or implementing decision hygiene—are these procedures relevant for every decision, for only some?

**Olivier Sibony:** There are some instances in which the value of the noise reduction may not always be worth the cost. If you are deciding at what price

you are going to make an offer to acquire a company, it's probably worth trying to reduce the noise in it.

**McKinsey:** What kinds of conversations and results do you hope to see from the book?

**Olivier Sibony:** There is an almost philosophical thing that I would like leaders to think about, which is this: If you expect others to agree with you, why aren't you trying more often to agree with them? Why do so many people, especially in leadership positions, seem to believe that their role is to express a unique, distinct, even original point of view on what needs to be done and, at the same time, find it troubling when others don't agree with them?

**Daniel Kahneman:** The goal is for the intellectual impact of the book to become embedded in the language so that it can become embedded in practice. If, in a few years, people understand the words “noise,” “noise audit,” and “decision hygiene” in the same way that they understand the word “nudge,” that's what we would hope for. That and the awareness that system noise is something all organizations should worry about.

Comments and opinions expressed by interviewees are their own and do not represent or reflect the opinions, policies, or positions of McKinsey & Company or have its endorsement.

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# Achieving win–win spin-offs

By acknowledging and addressing four factors relating to execution and operations, ParentCo can separate from SpinCo in a way that creates value for both.

*by Jan Krause, Anthony Luu, Robert Uhlaner, and Andy West*



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**A corporate spin-off** can liberate a parent company and a divested business unit from capital and bureaucratic constraints, so they can pursue strategies they couldn't otherwise. Yet their fates often remain linked.<sup>1</sup> For a spin-off to truly succeed, both ParentCo and SpinCo (and their investors) should end up in a place better than the one where they started. Indeed, our empirical research suggests that spin-offs outperform by supporting the long-term growth and value-creation opportunities of *both* entities.<sup>2</sup>

Getting to a win-win outcome is often easier said than done, however. Business leaders run into roadblocks when they make critical decisions about the structure of the arrangements between ParentCo and SpinCo and the execution of the spin-off itself—for instance, defining its scope, allocating talent and resources across both entities, and dealing with capital and stranded costs.

How can business leaders address these obstacles? Our analysis of more than 200 US spin-offs, as well as our experience in the field, point to four factors critical for achieving win-win spin-offs: a quick transition toward growth, operational excellence, leadership time and attention, and culture and talent.

By reviewing and addressing some or all of these factors, business leaders can increase the likelihood that any strategic decisions ParentCo and SpinCo make will ultimately create value for both.

### A quick transition toward growth

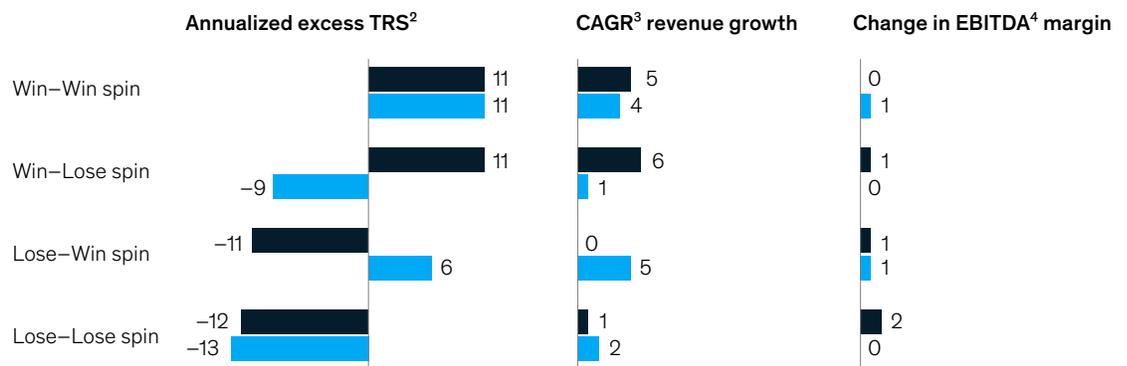
Our research shows that revenue growth is a critical determinant of a spin-off's success (exhibit). In most cases, the management teams of both ParentCo and SpinCo can adequately explain how growth is part of the spin-off's strategic rationale,

Exhibit

## Win-win spin-offs can create significant value.

Analysis of individual deals from separation date to 5 years after,<sup>1</sup> % (n = 230)

■ Spin-off company ■ Parent company



<sup>1</sup>Data are based on parent companies involved in a completed spin-off (>\$500 million) from 1992 to 2019. Benchmarked to the S&P 500 industry-specific index. Excludes deals in which length of time between announcement date and separation date was less than 8 months or more than 24 months.

<sup>2</sup>Total returns to shareholders.

<sup>3</sup>Compound annual growth rate.

<sup>4</sup>Earnings before interest, taxes, depreciation, and amortization.

Source: McKinsey Corporate Finance Spin-off data set

<sup>1</sup> We recognize that some spin-offs are tax-free transactions, which may involve other types of strategic and operational considerations.

<sup>2</sup> We reviewed completed corporate spin-offs that occurred from 1992 to 2019 and had a deal value of \$500 million or more, as well as five years of available data. We examined a range of deal metrics, including CAGR revenue growth and change in EBITA margins from the year of separation to five years afterward. Data were benchmarked to the S&P 500 industry-specific index. Our data set excludes deals in which the length of time between the announcement date and the separation date was less than eight months or more than 24 months.

alongside improved capital management and other operational changes.

But management teams are typically much less clear about how they will achieve growth. Understanding that “how” is crucial for achieving win–win spin-offs. Teams should come to the negotiating table with concrete plans to create growth and value for both companies. Achieving some quick wins, such as signing marquee deals or partnerships shortly after separation to build momentum for the spin-off, is often a good idea.

Consider the case of one technology-services provider. The parent company offered a range of end-to-end digital products and a technology infrastructure used by hundreds of clients. It saw opportunities to improve its core business so that it could appeal to new kinds of customers and expand into new markets. But capital and operational requirements in other parts of the business were preventing the move; there weren't enough resources to go around. After some internal discussion, business leaders explored spinning off a subsidiary that offered a type of B2B software. The transaction made sense for the software business, since it would be able to forge direct business partnerships with other technology-services companies.

To ensure a seamless transition, managers in the parent company and the subsidiary developed detailed day-one plans, including the creation of clearly defined account-planning teams, as well as an account war room to coordinate the handing off of major customers. For some customer segments, the parent company and the subsidiary also struck limited agreements to continue going to market together as channel partners. Ultimately, both entities benefited from the arrangement: the parent company funneled capital to higher-growth opportunities, and the spin-off grew in segments that previously hadn't been accessible given its association with the parent.

### **Operational excellence**

Companies that successfully execute win–win spin-offs tend to optimize the operating model for both ParentCo and SpinCo. In some win–win

spin-offs we examined, companies saw these deals as an opportunity to bolster their operations in high-growth areas—for instance, increasing their marketing expenditures or digitizing the sales process and expanding the sales force in certain segments. In other cases, companies sought to improve, centralize, or simplify the operating structures of the business units; many did so before day one.

A biotechnology company, for instance, recognized that by spinning off a noncore business unit focused on a particular category of therapeutics it could free up significant capital and use those funds to transform its product portfolio. But before the public announcement of the spin-off, the parent company initiated a series of actions to streamline its businesses: for instance, it accelerated its move away from some legacy manufacturing systems while restructuring its IT infrastructure and business processes. In this way, the biotech company could not only prepare SpinCo to compete effectively as a stand-alone organization but also improve operations across the remaining businesses. Through this process, the biotech company identified and reconciled stranded costs as well. Once the spin-off was announced, ParentCo and SpinCo both activated their business strategies sooner than they might have done otherwise and quickly targeted new growth opportunities in their respective specialty markets.

### **Leadership time and attention**

Companies frequently pursue spin-offs to free up management's time and bandwidth to, for example, refocus on the core business or launch a new one. But keeping executives focused on the big picture can be difficult. That's particularly true for SpinCo's executives, who must contend with all the challenges—such as developing and executing new strategies and managing new governance and reporting requirements—of establishing a new public company.

In our experience, many executives spend more time focusing on the mechanics of spinning off units than on the opportunities that deals may unlock or communicating those potential benefits to stakeholders. Many wait until the spin-off is

consummated before preparing for what comes next. In such cases, executives may be unable to capitalize on the momentum of the spin-off or, at worst, avoid being overwhelmed by the increased expectations and scrutiny of investors.

Win–win spin-offs require a clear understanding of priorities and a commitment by management to focus on them. The management team of a pharma company’s consumer–health spin-off, for example, spent considerable time developing a new narrative and equity story for the spin-off. The team knew it would need to build credibility with a new group of investors and educate them about the unique characteristics of the business and the market. This exercise, which involved leaders from both the parent company and the consumer–health spin-off, helped the spin-off’s managers to build a compelling story for investors, analysts, and other key stakeholders. Specifically, the team emphasized that the spin-off had more attractive financial returns and shorter R&D cycles than the parent company did. With this focused attention from management, the consumer–health spin-off enjoyed a relatively smooth path to independence and a successful public listing.

## Culture and talent

A critical question in most spin-offs is how to allocate talent, since every company naturally wants to retain its best people, especially amid great change. We observed that the leaders of the most successful spin-offs didn’t approach this question as a zero-sum exercise. Instead, they took the time to assess the cultures and capabilities each company would require to succeed in the long term.

Some developed a clean-sheet view of the desired organizational structures in both the parent

company and the spin-off. For instance, they identified the critical roles that would create the most value in the new organization and developed and implemented a plan to find the right people to fill those roles by recruiting externally, retraining internally, or some combination of the two.

Shortly after the announcement of a deal, one industrials spin-off sought to establish a culture that was very different from that of its parent company, an established brand with a strong identity in the marketplace. Because of that legacy culture, employees were reluctant to change certain processes (such as the way the company gathered market insights) or to adopt new digital capabilities. Realizing that a cultural shift was needed, the industrials spin-off announced its intention to move its headquarters away from the parent’s. The new HQ would be located in a region that could attract more professionals focused on emerging technologies and on experimenting with new processes being adopted in the industry. The HQ move jump-started the spin-off’s efforts to build a distinct culture and to adopt new structures and ways of doing things—while helping it to establish itself as one of the new disruptors in its industry.

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Spin-offs can give both companies more freedom and improve their performance if executives systematically consider the growth strategies, operations, talent, and cultural changes that each entity will require for a win–win scenario. Our research and analysis suggest that such reciprocity is not just nice to have but also a key requirement for success.

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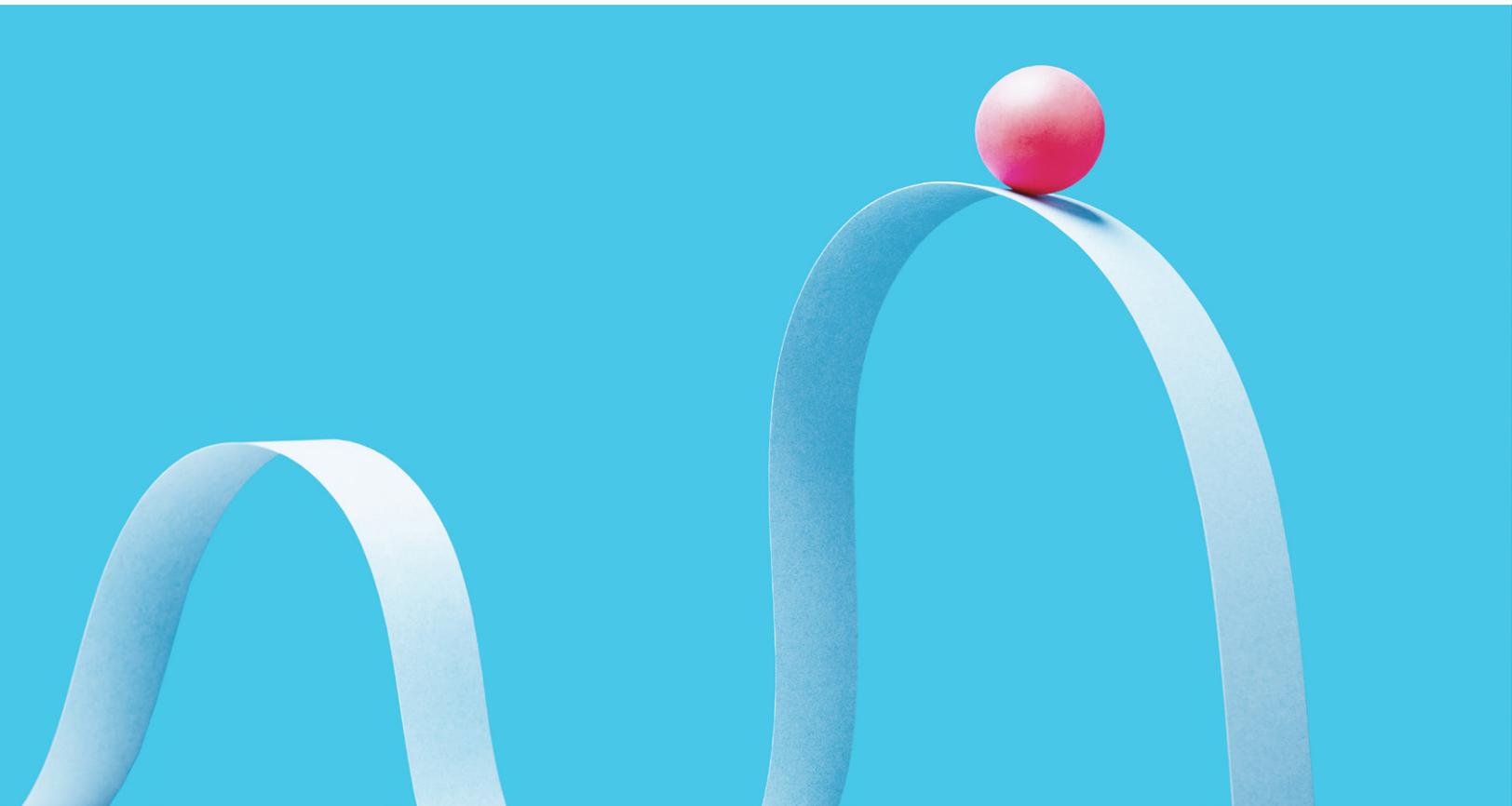
Despite their best intentions, executives fall prey to cognitive and organizational biases that get in the way of good decision making. In this series, we highlight some of them and offer a few effective ways to address them.

Our topic this time?

**Bias Busters**

# Taking the ‘outside view’

*by Tim Koller and Dan Lovallo*



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### **The dilemma**

You're the head of a major motion-picture studio, and you must decide whether to green-light a movie project. You need to predict whether it will be boffo (a box-office hit) or a bust. To make this decision, you must make two interrelated forecasts: the costs of production and potential box-office revenue.

Production costs are easy, you think: you know the shooting days, specific location costs, and computer-generated-imagery costs. You can enter these into a spreadsheet that reflects the film's production plan. Potential box-office revenue is harder to predict, but you know roughly how many screens the film will be on during opening weekend, how "hot" your stars are right now, and how much you're going to spend on advertising.

Do you have enough data to make a decision? Maybe. Are the data enough to make the right decision? Probably not. Research shows that film executives overestimate potential box-office revenue most of the time.

### **The research**

That's because film executives often take what Nobel laureate Daniel Kahneman and colleagues refer to as the "inside view."<sup>1</sup> They build a detailed case for what is going to happen based on the specifics of the case at hand rather than looking at analogous cases and other external sources of information. (If they do look at other data, it's often only after they've already formed impressions.) Without those checks and balances, forecasts can be overly optimistic. Movie projects, large capital-investment projects, and other initiatives in which feedback comes months or years after the initial decision to invest is made often end up running late and over budget. They often fail to meet performance targets.

### **The remedy**

One way to make better forecasts, in Hollywood and beyond, is to take the "outside view," which means building a statistical view of your project based on a reference class of similar projects. Indeed, taking the outside view is essential for companies seeking

**One way to make better forecasts is to take the 'outside view,' which means building a statistical view of your project based on a reference class of similar projects.**

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<sup>1</sup> Daniel Kahneman and Dan Lovallo, "Timid choices and bold forecasts: A cognitive perspective on risk taking," *Management Science*, January 1993, Volume 39, Number 1, pp. 17–31, [pubsonline.informs.org](http://pubsonline.informs.org).

to understand their positions on their industries' power curves of economic profit.<sup>2</sup> To understand how the outside view works, consider an experiment performed with a group at a private-equity company. The group was asked to build a forecast for an ongoing investment from the bottom up—tracing its path from beginning to end and noting the key steps, actions, and milestones required to meet proposed targets. The group's median expected rate of return on this investment was about 50 percent. The group was then asked to fill out a table comparing

that ongoing investment with categories of similar investments, looking at factors such as relative quality of the investment and average return for an investment category. Using this outside view, the group saw that its median expected rate of return was more than double that of the most similar investments (exhibit).

The critical step here, of course, is to identify the reference class of projects, which might be five cases or 500. This process is part art and part science—but the overriding philosophy must be that there is “nothing new under the sun.” That is, you can find a reference class even for groundbreaking innovations—something music company EMI (of the Beatles fame) learned the hard way.

In the 1970s, EMI entered the medical-diagnostics market with a computed-tomography (CT) scanner developed by researcher and eventual Nobel Prize winner Godfrey Hounsfield. The company had limited experience in the diagnostics field and in medical sales and distribution. But based on an inside view, senior management placed a big bet on Hounsfield's proprietary technology and sought to build the required capabilities in-house.

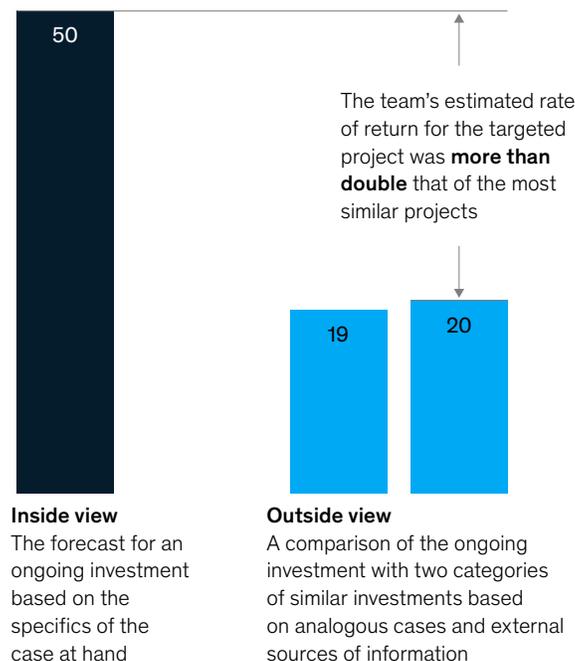
It took about five years for EMI to release its first scanner; in that time, competitors with similar X-ray technologies as well as broader, more established sales and distribution infrastructures overtook EMI. In seeking to do everything alone, EMI suffered losses and eventually left the market. Building a reference class would have allowed the company not only to predict success in the market for CT scanners but also to develop a more effective go-to-market strategy.<sup>3</sup>

Compared with EMI's situation, finding a reference class for a film project might seem like a no-brainer: you figure there will be lots of movies in the same genre, with similar story lines and stars, to compare

Exhibit

## Private-equity teams built a more accurate forecast using the outside view.

Estimated rate of return, %



<sup>2</sup> The power curve is a global distribution of companies' economic profit. For more on this concept, see *Strategy & Corporate Finance blog*, "Is your strategy good enough to move you up on the power curve?," blog entry by Martin Hirt, January 30, 2018, McKinsey.com.

<sup>3</sup> John T. Horn, Dan P. Lovallo, and S. Patrick Viguerie, "Beating the odds in market entry," *McKinsey Quarterly*, November 1, 2005, McKinsey.com.

with the focal project. And yet, when we asked the head of a major motion-picture studio how many analogues he typically used to forecast movie revenue, he answered, "One." And when we inquired about the most he had ever used, he said, "Two." Research shows that using the correct reference class can reduce estimation errors by 70 percent.<sup>4</sup>

Companies often think it's too hard and too time-consuming to build a reference class, but it isn't. In an effort to improve the US military's effectiveness

in Iraq in 2004, Kalev Sepp, a former special-forces officer in the US Army, built a reference class of 53 counterinsurgency conflicts with characteristics of the Iraq war, complete with strategies and outcomes. He did this on his own in little more than 36 hours. He and his colleagues subsequently used the reference class to inform their decisions about critical strategy and policy changes. Other organizations can do the same—learning as much from others' experiences as they do from their own.

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<sup>4</sup> Bent Flyvbjerg, Massimo Garbuio, and Dan Lovallo, "Delusion and deception in large infrastructure projects: Two models for explaining and preventing executive disaster," *California Management Review*, Winter 2009, Volume 51, Number 2, pp. 170–91, journals.sagepub.com.



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