# Chasing Down the Rebalancing Premium

By Anson J. Glacy, Jr.

*One day, Albert Einstein was walking across the quad having just given a test to his grad students. His assistant asked him, "Herr Professor, didn't you just use last year's test?" He responded, "Ja, ja, ja." The assistant said, "I'm shocked that you would use the exact same test with the exact same questions." Einstein said, "The answers have changed."*

In developing long-range investment strategies, investors conduct strategic asset allocation (SAA) exercises in pursuit of the asset allocations that optimally balance risk and return. They reach conclusions of optimality by using utility-like measures of subjectivity to identify "sleep-well-at-night" portfolios. Investors then rebalance these portfolios on a quarterly or annual basis in order to maintain the desired constant mix. Mechanical rebalancing strategies like these help investors control their risk exposures and remove uncertainty and emotion from the ongoing investing process.

For example, rebalancing to a traditional 60 percent stock/40 percent bond constant mix requires the purchase of stocks as they fall in value. This is known as a **concave** strategy because of the shape of its payoff profile and it tends to do well in conditions of market volatility. (In contrast, **convex** strategies that sell stocks as they fall in value (e.g., portfolio insurance, momentum strategies) tend to do less well in oscillating markets.) Concave strategies are also thought to deliver incremental returns (called a **rebalancing premium**) resulting from the buy-low-sell-high trading done to achieve the rebalancing.

For example, investors who rebalanced on March 31, 2020, during those turbulent market conditions would have sold a portion of their bond positions as Treasury note rates declined precipitously towards 0.50 percent, realizing capital gains, and then redeployed proceeds into stocks at depressed prices. These investors increased their stock holdings at a local bottom of the market, thereby increasing their participation in the market

recovery that followed. They probably will finish the year 2020 showing superior returns compared to "buy and hold" portfolios that were not rebalanced.

For another example, fund giant Invesco reported that it had failed to rebalance an equally-weighted S&P 500 mutual fund in April 2020, a mistake that cost investors $105 million. (Invesco agreed to reimburse investors.) The error came to light when a manager noticed that the mutual fund's performance began markedly trailing the otherwise identical ETF version of the fund, which **had** undergone the scheduled rebalancing. (One stock analyst estimated the error could cause a charge of 20 cents a share.)

## STRATEGIC ASSET ALLOCATION (SAA) ASSUMPTIONS

SAA relies on coherent forecasts (i.e., capital market assumptions) of long-term investment expectations and variability. Such forecasts are usually presented in the standard mean-variance framework of expected returns, volatilities and correlations:

Expected return—average annual return over the long-range horizon;

Volatility—the standard deviation of annual returns; and

Correlation—how closely associated returns of various investments are with each other.

Practitioners often rely on J.P. Morgan's long-term capital market assumptions in strategic asset allocation work, assumptions designed to extend over the 10- to 15-year time frame that is appropriate for insurance company ALM or pension plan work. J.P. Morgan employs a team of over 50 economists and strategists to recalibrate its forecasts annually to incorporate new information presented by markets, policymakers and the mainstreet economy itself. Prompted by springtime market events, J.P. Morgan for the first time published off-cycle adjustments to its assumptions on April 30, 2020.

## COMPUTING THE REBALANCING PREMIUM

Consider a portfolio of two assets whose returns are normally distributed with identical mean return μ, variance $\sigma^2$, and with zero correlation. The expected growth rate of each asset is μ - $\sigma^2/2$, after adjusting for volatility drag (i.e., a stock that drops 20 percent needs to rise 25 percent to recover). For simplicity, assume rebalancing to a 50/50 portfolio. Invoking the self-financing constraint that the purchase of new units of one asset is financed by the sale of the other, it can be shown that the expected growth rate of the two-asset portfolio is μ - $\sigma^2/4$ and thus the rebalancing premium in this simple case is $\sigma^2/4$. In the case of non-zero correlation $\rho$, the rebalancing premium is $\sigma^2(1 - \rho)/4$.

From 2010 through 2019, S&P 500 realized volatility averaged about 15 percent. If the bond market had exhibited similar volatility and assuming no correlation between the two markets (both tenuous assumptions), the rebalancing premium for a 50/50 investor was 0.56 percent using the above formula.

## EXPLOITING THE REBALANCING PREMIUM

The mean-variance mathematics underlying these calculations is highly tractable, requiring only the solution to a quadratic optimization problem. Therefore, it is possible to create portfolios of individual stocks and bonds designed to maximize the rebalancing benefit. This practice is called **volatility pumping** or **volatility harvesting** and was first formalized by Oxford professor David Luenberger in his textbook Investment Science (Oxford University Press, 1997). As Luenberger puts it (page 429), "Volatility is **not** the same as risk. Volatility is opportunity."

Luenberger observes that "when assets are combined in proportions, the resulting μ is a proportional combination of the individual μ's. However, the resulting $\sigma^2$ is reduced more than proportionally because it combines individual $\sigma^2$'s with

squares of the proportionality factors." Therefore, the aggregate growth rate is greater than the proportional combination of the individual growth rates. It is "pumped up" by the reduction in the volatility term.

In general, the greater each constituent asset's volatility, the greater the overall rebalancing premium. In contrast, the greater the correlation among assets, the lesser the rebalancing return. These findings are intuitive. (But note that an increase in asset volatility increases the growth potential from rebalancing but also increases portfolio variance, decreasing growth **via** volatility drag).

The enterprising practitioner, armed with a suitable investment data feed and an optimizer, can easily build portfolios of S&P 500 subsets designed to harvest volatility. Certain **risk parity** strategies followed by major investment houses are designed to realize incremental returns through rebalancing. The amount of return generated through rebalancing is a function of asset class volatilities and diversification. In a risk parity portfolio, assets are selected based on their diversification potential and levered up or down to attain a target volatility. This construction process creates an ideal environment for systematically harvesting gains in the portfolio through rebalancing.

## LITERATURE REVIEW

Maeso and Martellini ("Measuring Portfolio Rebalancing Benefits in Equity Markets," The Journal of Portfolio Management, March 2020) found that the outperformance of a rebalanced strategy compared to its buy-and-hold counterpart is in excess of 1 percent per annum for stocks in the S&P 500 index. Anderson, Bianchi, and Goldberg ("Will My Risk Parity Strategy Outperform?" University of California at Berkeley, 2012) found that a rebalanced constant mix of 60 percent stocks and 40 percent bonds, after transaction costs, outperformed a buy-and-hold mix by 74 basis points per year from 1926 to 2010 with significantly lower volatility.

William Bernstein *(www.EfficientFrontier.com)* observes that the average annual return on common stocks and long-term corporate bonds between 1926 and 1994 was 10.19 percent and 5.51 percent, respectively, returning 7.85 percent for a 50/50 buy-and-hold mix. Rebalancing this portfolio annually to maintain a 50/50 constant mix would have yielded a return of 8.34 percent, implying a rebalancing premium of 0.49 percent. But Bernstein notes that if one had put equal amounts of money into stocks and bonds on the day of Jan. 1, 1926, and had not rebalanced, the return would have been 9.17 percent. During that 69-year period the significantly higher stock return overwhelmed the bond return, causing the stock component to be greater than 90 percent for the last 40 years of the period. The higher return from the buy-and-hold portfolio comes at the cost of a much less diversified and therefore dramatically more risky portfolio than the rebalanced one.
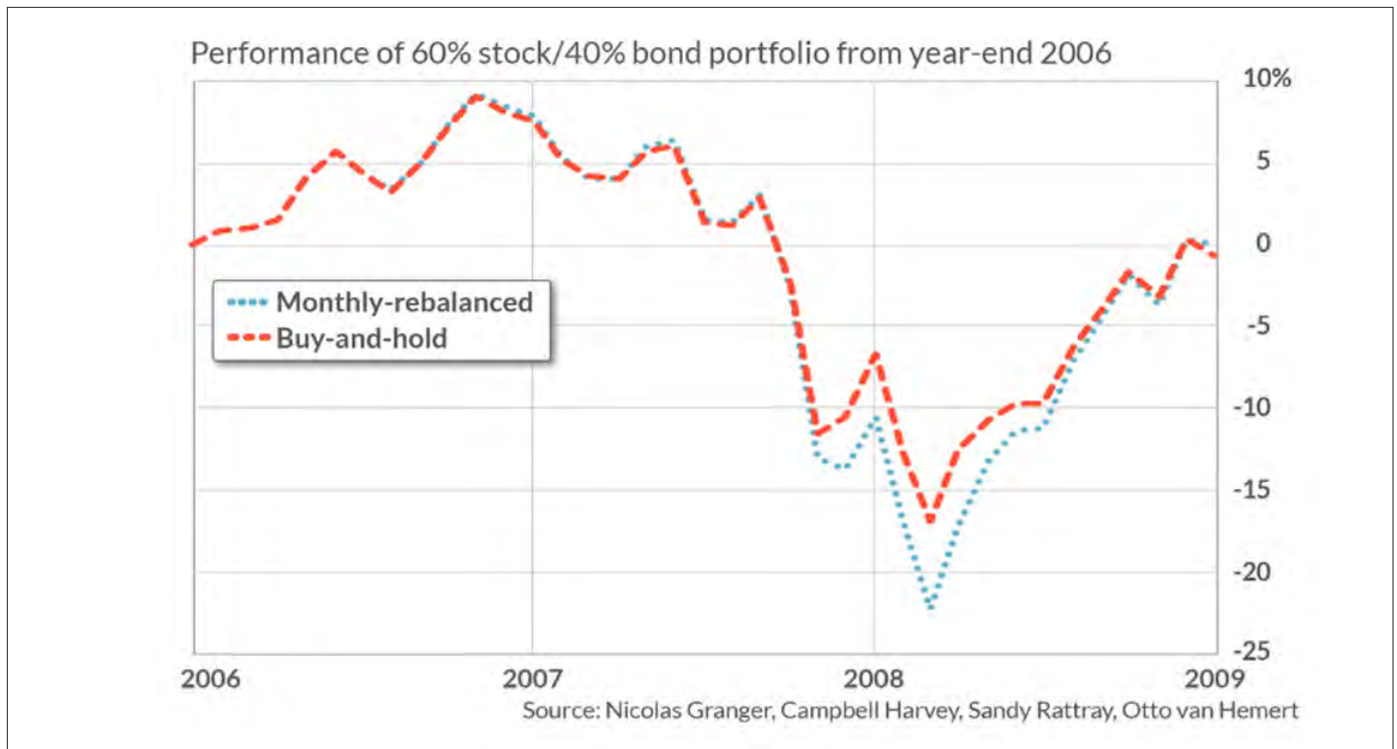
## OTHER VIEWPOINTS

However, other investigators have dissented. For example, Cuthbertson, Hayley, Motson and Nitzsche ("What Does Rebalancing Really Achieve?" *International Journal of Finance & Economics*, 2016) point out that comparison between rebalanced and buy-and-hold portfolios is confounded by the fact that, even when the portfolios are identical at the start, the composition of the buy-and-hold portfolio tends to wander over time. They demonstrate analytically that "the greater expected growth of rebalanced strategies is **entirely** (emphasis added) explained by

their lower portfolio volatilities rather than—as is claimed—being due to the rebalancing trades themselves being profitable."

British actuary Andrew Wise ("The Investment Return from a Portfolio with a Dynamic Rebalancing Policy," *British Actuarial Journal*, 1996) concluded that a rebalancing strategy will beat a buy-and-hold strategy about two-thirds of the time when the constituent assets in the portfolio have identical mean-variance return expectations. But when buy-and-hold beats rebalancing, it beats it by a much larger margin, so that the returns to rebalanced and buy-and-hold, in the equal expected returns case, are identical. Wise joins with Cuthbertson et al. to conclude that apparent rebalancing superiority is actually a risk-return tradeoff in disguise.

Popular financial writer Mark Hulbert examined the historical performance of rebalancing ("Almost All Retirees Make This Mistake," *MarketWatch*, July 2019), counseling skepticism of any advice that is almost universally touted. In reviewing the performance of numerous asset allocations involving regular rebalancing, he found that many portfolios performed "far worse" than expected and that rebalancing was the likely culprit. He cites the experience of the 2007–2009 Global Financial Crisis when the stock market fell for six calendar quarters in a row, with losses growing progressively larger as the crisis unfolded. A strategy of regular rebalancing would have magnified losses rather than reduced them. (See Figure 1)

Figure 1
When Rebalancing Went Astray



Performance of 60% stock/40% bond portfolio from year-end 2006

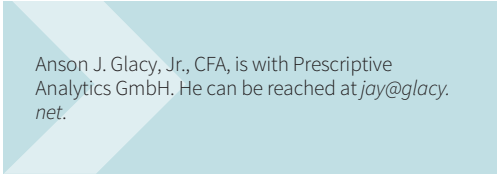Source: Nicolas Granger, Campbell Harvey, Sandy Rattray, Otto van Hemert

Hulbert does recognize the value of rebalancing in maintaining one's strategic asset allocation and in adding value in sideways markets. But he prefers to marry rebalancing with a momentum strategy in order to guard against severe market drawdowns.

## CONCLUSION

Regular asset rebalancing to a rigorously determined strategic asset allocation is an accepted practice for investors to optimize their long-range investing performance. The academic literature concludes that under certain conditions that may or may not exist in reality (i.e., independently and identically distributed assets following a random walk), a rebalanced portfolio has a higher expected growth rate than its buy-and-hold counterpart.

The topic continues to generate lively controversy among interested parties. A growing number of academic papers wrestle with differing interpretations of the same empirical evidence and with competing methodological approaches for measuring the rebalancing premium. Future installments will report on the continuing research and discuss how practitioners can incorporate findings into investment and risk containment strategies. ∎

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# Analyzing Current Behavioral Trends: Predicting Markets Through a Pandemic

By John M. Burkhardt

The disruption to the global economy and financial markets consequent to the COVID-19 pandemic is unprecedented in recent history. While some level of contraction was to be expected, volatility and unexpected swings have stymied many professionals. In the face of this, how can organizations chart a strong and stable course?

## THE ISSUE OF VARIABLE BASELINES

Modeling markets has proven quite difficult over the last several months. This largely arises from the fact that it is difficult and likely impossible to establish any sort of meaningful baseline to model against. Government policy has been adjusted weekly, travel restrictions have shifted continuously, classes of business permitted to open have constantly changed. This would be challenging enough, but there is additionally the concurrent issue of a continually-evolving pandemic as well. Our understanding of COVID-19 pathology and morbidity updates daily. The comparatively stable baseline against which markets operate and people live their lives has become highly variable.

The challenge here is that a shifting baseline strips conventional models of their predictive efficacy. Perniciously, however, this fact is not immediately clear. Conventional outcomes and key performance indicators can still be measured by the same approaches normally used. Meaningful conclusions cannot be drawn from these measures, however. There is no reasonable way to determine whether an observed outcome is a consequence of market movement, baseline movement, or some combination of both, and so interpretation of any observed changes becomes more of an exercise in reading tea leaves than genuine quantitative inference.

Because conventional models break down under variable baseline conditions, one must rely on understanding the biases and behaviors of individuals to arrive at useful predictions of future market activity. Instead of attempting to model the market as a whole, it is more fruitful to examine the activities of the individuals whose decisions and resources collectively make up the market. This is a considerably more granular and therefore intensive process, but one that allows for substantially more analytical flexibility and robust predictions.

## DETERMINANTS OF BEHAVIOR

Human behavior under risk is driven by a consistent set of rules and heuristics, a consequence of evolution that served to keep our ancestors alive during a considerably less forgiving epoch. That modern humans seldom face survival pressures anymore is immaterial; these rules are hardwired into our brains. Central to this discussion are three interconnected phenomena: minimization of uncertainty, behavioral inertia, and loss aversion.

Much of human behavior is driven by a generalized dislike for uncertainty. In an unstable environment, people will tend towards behaviors that are rooted in certain, easily understood information, and simplify their mental processing as much as possible. This functions as both a driver itself, leading to the exaggeration of existing behaviors, as well as an informational cue to engage downstream heuristics. Unfortunately, it is nearly impossible to predict which behaviors will become entrenched and exaggerated during a crisis, only that some will. This is due to the founder effect phenomenon. Classically described as a loss

of genetic variance when a small number of individuals establish a subsequent population, here the founder effect describes the loss of behavioral variance when an initial behavior, such as hoarding toilet paper, propagates within a group.

The continuation of established behaviors is also governed by behavioral inertia. This is defined as the general tendency for people to persist in what they're already doing, minimizing mental effort. Inertia becomes particularly relevant in understanding the likelihood of adoption of new behaviors. Finally, loss aversion governs most comparison-based decisions. In the face of multiple options, individuals tend to pursue wins that are most certain regardless of magnitude, and losses that are least painful regardless of probability.

Contrary to popular belief, people's attitudes and intentions are comparatively unimportant in driving their behavior. While comparatively easy to measure, attitude is a remarkably poor predictor and driver of behavior. As such, predictions based on the consumer confidence index and related measures are less useful than one might hope.

## WHY TOILET PAPER?

A common question over the last several months has been: Why toilet paper? What made people fixate on toilet paper and frantically hoard it, to the point of creating an artificial shortage? The hand sanitizer shortage is something that people can generally understand, but … toilet paper? As it turns out, this is an excellent question for examining and understanding what's driving a large array of behaviors that have been occurring during the pandemic, and helps identify the types of predictions that can be made about human behavior in the coming months.

At the root of this is people's intrinsic dislike for uncertainty. While human brains are good at making decisions around very likely and certain outcomes, they're considerably less adept at handling uncertainty. Consequently, individuals tend to seize onto any fragment of certainty encountered and anchor actions there.

In the initial phases of the Coronavirus outbreak, very little was known about its relative risk and how best to respond, a recurring theme throughout the pandemic. Appropriate individual actions were unknown. It was widely reported that gastrointestinal symptoms were an indicator of infection, and early news reports advised having toilet paper on hand in the event of infection. This amounted to a founder effect of sorts. As the first wave of buyers descended on stores, social proof compounded by loss aversion engaged. All these other people are buying toilet paper; there's so little left on the shelves; I need to buy some now. As supply at the time was largely inelastic, there was no way for the market to attenuate this feed-forward response.

There are strong parallels between this and the gasoline shortages in the early 1970s. Both cases witnessed a utilitarian

commodity of limited availability being hoarded during a period of global uncertainty. Commoditized, utilitarian behaviors have a much greater propensity to spiral out of control.

The import of all of these contributing factors becomes even more clear when examining a more recent question: Why can people be persuaded to buy toilet paper but not wear masks? Beyond the fact that buying toilet paper is an established behavior while wearing masks is not, minimization of uncertainty again has outsized impact in influencing behavior. In the United States, initial guidance suggested that masks were ineffective—recommendations to wear masks came weeks later. There have since been conflicting reports on mask efficacy from various health agencies. All of this reduces the perceived certainty around masks, which in turn diminishes the trend to wear them. Social proof again comes into play, but here it works against the behavior. The lack of uniform social behavior reduces the propensity of individuals to wear masks. Toilet paper, on the other hand, has never been subject to any of these pressures—no one in modern history has ever suggested that toilet paper shouldn't be used.

## WHAT'S ON THE HORIZON?

Knowing all of this, what trends can be extrapolated? While it's unclear at the time of this writing whether there will ever be a full return to pre-pandemic normal market and social behaviors, the activity level emerging from the lockdown and stabilization of behavior will occur in a gradated fashion. In the initial draft of this article, it was postulated that the initial re-emergence of normal market activity would occur over the next four to six months. However, this estimate quickly became obsolete as domestic infection rates spiked, offering a clear illustration of the variable baseline issue described above.

It appears more and more likely with each passing day that much of the market disruption that has occurred will persist even after COVID-19 is not a top-level concern. Current practices have persisted long enough to acquire inertia—that is to say, they are new baseline behaviors. This is readily observable in sectors such as commercial real estate, business travel, and green behavior initiatives such as reduction in premises and institutionalized work-from-home policies. It will be most relevant, however, and most impactful, in personal financial behaviors. A "new normal" for personal behaviors has not yet coalesced, but the relevant determinants of behavior are clear, and extrapolations can be made.

The future movement of the financial markets is remarkably difficult to predict with any specificity, due to continuously emerging factors such as the opening and closing of borders, spikes in infection rates and government responses to them, and the amount and nature of federal relief packages. It is clear that the U.S. stock market in general will suffer at least one additional major dip, which at the time of this writing in July of 2020 may already be occurring. Volatility will remain high

but gross trajectory will be downward. From this and the last six months, strong predictions can be made around the population response.

## A BRIEF SNAPSHOT: 20 MINUTES INTO THE FUTURE

By way of example, one can expect to observe a change in individuals' financial behaviors in a complex and binary fashion. While superficially it will appear to be a divergence of haves and have-nots, in fact the determining factor will be debt. Avoidance of risk and loss will be a major determinant; individuals with the means to do so will contract their personal debt as much as possible so as to minimize risk exposure. They will also tend to pivot to more stable investments, resulting in the sale of high beta securities and aggressive growth funds. While the traditional market haven in uncertain times is U.S. Treasuries, it is not clear that this will hold true for individual investors. The concurrent anti-police and anti-government protests in the wake of George Floyd's death serve as something of a wildcard here. Source credibility with the U.S. government is low, so government-backed bonds are not as attractive an option as they historically have been. Cash may become a commonplace holding.

In marked contrast, those with significant debt and without the means to reduce it will accumulate even greater debt. This will be facilitated by reduced and lost employment, as well as poor understanding of the specific requirements of the relief provided by the CARES Act. Moreover, in loss-certain and aversive scenarios, it is known that individuals become much more speculative and willing to take on further debt, gambling on spending their way out of insolvency against a high probability of default. Among active investors in this population, speculative investing and short positions will increase. Barring an extension of CARES, one can expect to see a surge in individual and small business bankruptcies during the second half of 2020 as overextended accounts come due.

This is expected to facilitate a tightening of credit spreads beyond what is already being observed, as well as a general contraction of interest rates. If unemployment remains elevated through the end of 2020 (a likely outcome at this juncture), one can expect the changes in personal financial behavior to move from being reactionary to becoming entrenched, and credit spreads and interest rates will remain depressed for the indefinite near-term. Depending on how long businesses remain closed or at reduced capacity, there may also be sufficient reduction in spending over a sufficiently long time such that negative interest rate policy becomes a realistic discussion. This will be heavily affected by the outcome of the November presidential and congressional elections, a topic too broad and complex to discuss here.

Institutional behaviors are generally prone to greater inertia than individual behaviors, and generally show lower magnitude of change, even in crises. However, at a certain scale of crisis, the seismic shift in environment can create rapid adjustments in even the largest organizations. On the institutional level, three general classes of actors are expected to emerge to shape the coming months: those without means, those with means, and those with means and appetite. Organizations without means—i.e., those with limited cash reserves, significant debt, and products and services that are in low demand through the pandemic—largely will serve as fodder. The current wave of corporate bankruptcies (600 in June alone) is unprecedented in recent history. This will both feed the distressed asset market and facilitate a divergence in surviving organizations. Most organizations will be expected to display normal risk-averse behavior, minimizing loss exposure and expenses.

However, organizations with risk-positive tendencies will become even more so. Key predictive factors include an existing expansion mindset and aggressive leadership. Risk-positive behaviors will be amplified, effectively creating an acquisition-minded subset of organizations displaying gambling behavior. Small and mid-sized organizations will face a substantially-increased risk of predation, and there will be a substantial amount of consolidation within sectors over the next 12 to 18 months.

## SUMMARY

Traditional predictive tools are not built to deal with the variability the world currently faces. The COVID-19 pandemic amounts to a prolonged black swan event, for which one must look past conventional assessments to arrive at any level of confident predictions. Behavioral analysis factors for biases and heuristics designed specifically for uncertain evolutionary contexts, and these heuristics are the primary drivers of market participants' decisions at present. Through understanding the most likely behaviors of individuals, it becomes possible to arrive at an aggregate understanding of market outcomes. ■

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# Crossword Puzzle: Perils of Wisdom

By Warren Manners
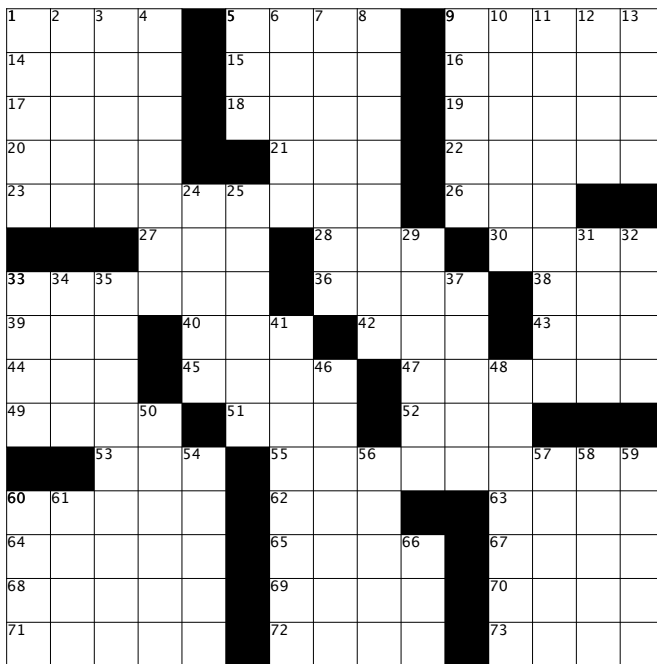
## Across

1 MS data mining tool
5 Money of Lesotho
9 Point on a line
14 Founding owner of the New York Giants
15 He's "Famous"
16 Hostile
17 Type I diabetes (abbr.)
18 King of Sodom
19 Nautical term
20 G
21 Mouth
22 Mundane
23 Bob Dylan song?
26 Fortune, to Shakespeare
27 Signed into law Mar. 2010
28 Doting letters
30 Cats and dogs
33 Leo's older brother
36 Waves, on the Ebro
38 Hitch
39 Put on
40 Frat letters
42 Cleopatra's killer
43 Out of sorts
44 First lady McKinley
45 Scene piece
47 "You are too officious in her _____ that scorns your services": Shakespeare
49 Eyepiece
51 Permit
52 Doce meses
53 Radio-wave abbr.
55 Dean Koontz novel?
60 Sicken
62 Occupational suffix
63 Nebraska tribe
64 Quarter-round molding
65 Flanged fastener
67 B-side of "Paperback Writer"
68 Power relay
69 Last of the Stuarts
70 Besides
71 Chipped in
72 "Why not?"
73 Examines closely

## Down

1 Forger
2 Hindu mystic
3 Enthusiasm
4 Miyamoto Musashi
5 Burner setting
6 Physics particle
7 SkyDome locale
8 Queen who bankrolled Columbus
9 Woody Allen play?
10 Set up
11 Sudden change of fortune
12 Skip
13 Hunt and peck
24 "Impossible"
25 _____ Friday
29 Algerian quarter
31 Cultivate
32 First person
33 Iron clothes
34 Orderly
35 Captivate
37 Weary
41 Emaciated
46 Saint-_____, Loire's capital
48 Plaque recipient
50 Table
54 James Joyce poem?
56 Foot soldier
57 Po River locale
58 Disturbance
59 Pool contents?
60 Parks on a bus
61 Roulette bet
66 QB's targets

The solution will be provided in an upcoming issue of *Risks & Rewards* along with the names of those who were able to successfully complete it. Submissions should be made to *sphillips@soa.org* by Oct. 31, 2020. ■

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## Very Interesting From February 2020

| C | H | I | R | P |   | C | M | B | R |   | E | C | R | U |
| R | O | D | E | O |   | R | O | L | E |   | P | L | U | M |
| Y | U | L | E | S |   | E | R | O | S |   | H | A | S | P |
| P | R | E | F | E | R | E | N | C | E |   | E | S | E | S |
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| U | R | I | C |   | A | L | T | O | S |   | A | A | R | P |
| T | O | Q | U | E |   | S | E | A | H | O | L | L | Y |   |
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|   |   | I | D | E | S | T |   |   | J | E | S | U | I | T |
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| A | M | I | R |   | L | I | A | O |   | E | N | D | O | N |
| R | O | T | A |   | V | L | D | L |   | S | O | U | N | D |
| T | Y | Y | N |   | O | L | E | D |   | T | R | E | S | S |