

# "That's What's Magic"

COULD A NEW R&D METRIC GIVE ANALYSTS MORE INSIGHT THAN STANDARD MEASURES?

By Rhea Wessel

Most companies calculate their target research and development (R&D) spending as a percentage of their sales. According to some, however, this method of calculation does not lead to optimal R&D productivity. In fact, its inaccuracy opens up an opportunity for investors, says Anne Marie Knott, professor of strategy at Olin Business School at Washington University in St. Louis.

Six years ago, Knott was deeply involved in her work valuing the productivity of R&D at companies using a measure called the “research quotient” (RQ) when she received an email from a portfolio manager at Goldman Sachs looking for ways to construct R&D portfolios.

Knott had the idea to examine historical data for

publicly traded firms in the US to see how RQs predicted companies’ bottom lines and market value. Knott used 47 years of data to create a portfolio of the top 20% of firms, weighting them equally and rebalancing each year. The result was that Knott’s portfolio outperformed the S&P 500 Index by a factor of four.

Firms (and, accordingly, investors) can benefit from knowing their RQ because it can be used to determine their optimal level of R&D investment. If the top 20 firms traded on US exchanges had optimized their 2010 R&D spending using Knott’s RQ method, the collective increase in market cap would have been \$1 trillion, according to her 2012 article in *Harvard Business Review* (“The Trillion-Dollar R&D Fix”).

In this interview, Knott shares insights about how RQ works and the ways it can be useful for investors.

## What is the research quotient?

RQ can predict how much a firm should spend on R&D, if the company is doing it optimally, and what would be the market value and firm growth as a result.

I calculate RQ similar to the way economists calculate labor and capital productivity, but I add another input: R&D. Thus,  $Y = K^{\alpha}L^{\beta}R^{\gamma}$ , where  $Y$  = output,  $K$  = capital,  $L$  = labor, and  $R$  = R&D.

The exponents indicate how productive each input is in generating output. For example,  $\gamma$  in the equation above tells the increase in a firm’s revenues resulting from a 1% increase in R&D spending.

When I was developing the RQ measure, I shared it with my finance colleagues, thinking they would all get excited about it. But they were concerned RQ could be picking up a bunch of other stuff, so we did a formal paper that showed how much excess return you get after you control for all the other things that might generate excess returns. RQ is still significant. In fact, it’s more significant than all the other standard measures.

## Why aren’t current measures of R&D useful?

Usually, companies use sales divided by R&D as an indicator of R&D productivity. But this is really just turning their budgeting rule (R&D as a percent of sales) upside down. So, it doesn’t really tell us anything. Academics look at the number of patents as an indicator of R&D productivity, but patents are actually negative in predicting market value and firm growth. In addition, less than 50% of the companies that conduct R&D actually file patents in the same year, so we have no measure for the other 50%. Finally, only 10% of patents comprise 85% of all patents’ economic value.

## How have companies reacted when you showed them their RQs?

Firms are pretty excited about it. I was giving one company the RQs for each of their divisions. What’s fun about that is that it allows you to look at why one division is more productive than another and use that throughout the firm to raise the whole level of innovation.

What I first did was show them what they were spending on R&D for the entire company over time and what they should be spending on R&D. Basically, they were off by a factor of six. They should have spent six times more on R&D.

The chief technology officer saw that and said the divisional finance managers would laugh. “We can’t be off by that much.” Then I showed him the same number for their optimal advertising spending, and the company was straight on with that. The difference between advertising and R&D is that you can see the impact of advertising in the same period as your spending, and that allows people to develop intuition about the right amount to spend. This is not the case for R&D.

## Where do investors come into the picture?

My measure of R&D productivity was originally published in 2008, and in 2012, I had an article about it in *Harvard Business Review*. After that, I began to go to firms and ask, “Why aren’t you optimizing R&D spending?” The answer: “The investors won’t let us. They don’t know how to value R&D.”

Now, some investors are valuing R&D to find opportunity

Many firms are spending only a fraction of what they should on R&D.

Identifying firms with high research quotients (RQs) will allow for investments in firms that others are overlooking.

Though RQ is a valuable tool for investors, what drives it remains elusive to researchers.

in companies that are flying under the radar. It's a bit like baseball. In baseball, the teams used to pick their players with scouts that would go out, watch people play, and recruit based on their intuitions. Well, it turns out their intuitions were wrong. Billy Beane, an American baseball scout, exploited that. He could buy guys for nothing because they didn't look like baseball players, but they had great performance. Apply this to the RQ, and the point is that if you actually identify the firms with high RQ, you'll be able to invest in firms that other people are overlooking.

A second investment strategy is to watch when firms change their R&D or change their RQ so you can trade ahead of the market reaction. A third one is to be an activist investor to actually get the firms to spend closer to their optimal amount on R&D.

### What are you working on now?

I'm working with National Science Foundation data on firms' R&D practices to identify what makes firms have a high or low RQ. It's something that could support a fourth investment strategy, though I'm not so concerned with investment strategies in my research. All

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"Solving Short-Termism," *CFA Institute Magazine* (November/December 2015) [[www.cfapubs.org](http://www.cfapubs.org)]

"Capital Conundrum: Evaluating a Management Team's Research and Development," *CFA Institute Annual Conference blog* [[annual.cfainstitute.org/blog](http://annual.cfainstitute.org/blog)]

I can say is where I see potential opportunities.

A fourth strategy could be for analysts to begin to understand why firms have a high or low RQ. Analysts have an advantage here because they go into companies and actually get to see what the firms are doing differently. They can figure out how it will affect the RQ and then can trade before RQ has actually changed.

### Do you have any caveats?

Ultimately, you should be able to trade on somebody's RQ changing, but right now, I don't know the factors that drive RQ. I am actually asking analysts to fill out a survey to tell me which factors they think affect RQ and in which direction.

This is a great research challenge for me because I know everybody's RQ. I just don't know what drives it, and that's what's magic. That's where the real power is going to come from. Right now, there are opportunities due to the mismatches, but the real opportunity is to actually understand what's driving RQ.

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