Are You Asking the Right Questions About Factor Investing?

Key Ideas

- The questions you might ask your doctor or pharmacist about a drug apply to factor investing too. By asking them, we believe you'll view factor exposures beyond their advertised claims of compensated risks; rather, you may find the need to diversify – even limit – your exposure to them because of the uncompensated risks they represent.
- We observe that the alpha potential for factors is fragile and current applications are constrained in two important ways. First, investors have overused the factors that were easy to discover. Second, statistical analysis used to improve or discover factors has become increasingly less productive.
- A better use for factors by investors today is to help evaluate their systematic risks, which threaten more than just factor investors. Other investors must also take notice of overcrowding risks, and step aside when hot trades roil the markets.
- By decomposing factor performance into stock- and portfolio-level effects, we can understand exposure to factors' diluted alpha potential while carefully managing their uncompensated risks. Both serve our collective goal: better risk-adjusted outcomes.

UNCORRELATED ANSWERS®

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Distinguished Researcher

Intech®

Understand your prescriptions

Only the United States and New Zealand allow direct-to-consumer advertising for prescription drugs. In the U.S. alone, pharmaceutical companies spend nearly $10 billion annually to advertise drugs.[1] Advertising is so widespread that Harvard Medical School suggests due diligence questions for consumers.[2] We've listed a few below. What does this have to do with investing? Well, we contend that the similar proliferation of factor-based products demands that you start asking similar questions.

Questions About Drugs		Questions About Factors
What condition does this drug treat?		What is the factor's alpha potential?
Which of the drug's possible side effects should I be worried about?		Does the factor itself create risks?
Should I take this drug if I'm taking other drugs?		How does it interact with other factors?

The popularity of factor investing – like the overuse of antibiotics – appears to be at a critical stage. While investors' adoption of factors has never been broader, their concerns about the effectiveness of factor investing are increasing. In our opinion, asking the right questions about factor investing has never been more justified.

A NEW INVESTING PARADIGM IS BORN

Crystalized in the labs of academia, factors were an attempt to study investing systematically within a quantitative framework. Researchers steeped in economics employed well-established regression techniques to explore which "factors" can be used to reliably forecast future outperformance of a security, relative to its peers.

Starting with factors used by investors in practice, like size and value, early researchers confirmed a clear statistical basis. And, like good scientists, they next sought to understand the mechanisms that underlie these statistical observations.

In the meantime, the broader investor community put the research results to work in hopes of generating outperformance. Over time, the statistical methodology for understanding factors evolved from an intermediate step in quantitatively analyzing the market to a fully self-contained paradigm for quantitative investing.

We can roughly summarize this quantitative worldview as follows:

> *Enough investors behave predictably that their biases meaningfully influence securities' behavior.*

Adherents to this paradigm wield statistical analysis to demonstrate the existence of a factor, to estimate its alpha potential and to measure its persistency. Quantitative investing tends to become all about factors: improving the calibration of known factors, and discovering new ones.

History of factor investing

Over the last 50 years, academic researchers and industry practitioners have identified hundreds of factors that seek to explain differences in stock returns.

1964
The capital asset pricing model (CAPM) plants the seeds of factor investing. The model separates market factor beta from stock-specific alpha.[3]

1972
Haugen and Heinz propose that low volatility stocks offer better risk-adjusted returns.[4]

1976
Ross introduces the arbitrage pricing theory (APT) that posits a multi-factor model for explaining stock movements.[5]

1981
Banz proposes that smaller company stocks outperform larger companies over long periods.[6]

1992
Fama and French suggest that value stocks have higher expected returns than growth stocks and create a 3-factor model to explain performance: market, size and value.[7]

1993
Jegadeesh and Titman posit that there was a premium for investing in high momentum stocks.[8]

1997
Carhart proposes a 4-factor model – market, size, value and momentum – to explain performance.

2007
Cooper, Gulan and Shill put forward the idea that asset growth predicts future stock returns.[9]

2009
Researchers at the Norwegian Government Pension Fund suggest that exposure to systematic factors drove two-thirds of their performance.[10]

2010
Novy-Marx proposes that operating profitability is a strong predictor.[11]

2014
Fama and French give rise to a 5-factor model by adding operating profitability and asset growth.[12]

Factor investing challenges

Investment professionals worldwide have turned to factor investing as a prescription for generating alpha. With enough history available, we are beginning to see some of the challenges to this quantitative investing paradigm. Two inevitable issues have emerged from our vantage point. First, investors have overused the factors that were easy to discover. Second, statistical analysis of factors used to improve or discover factors has become increasingly sterile.

Too much of a good thing?

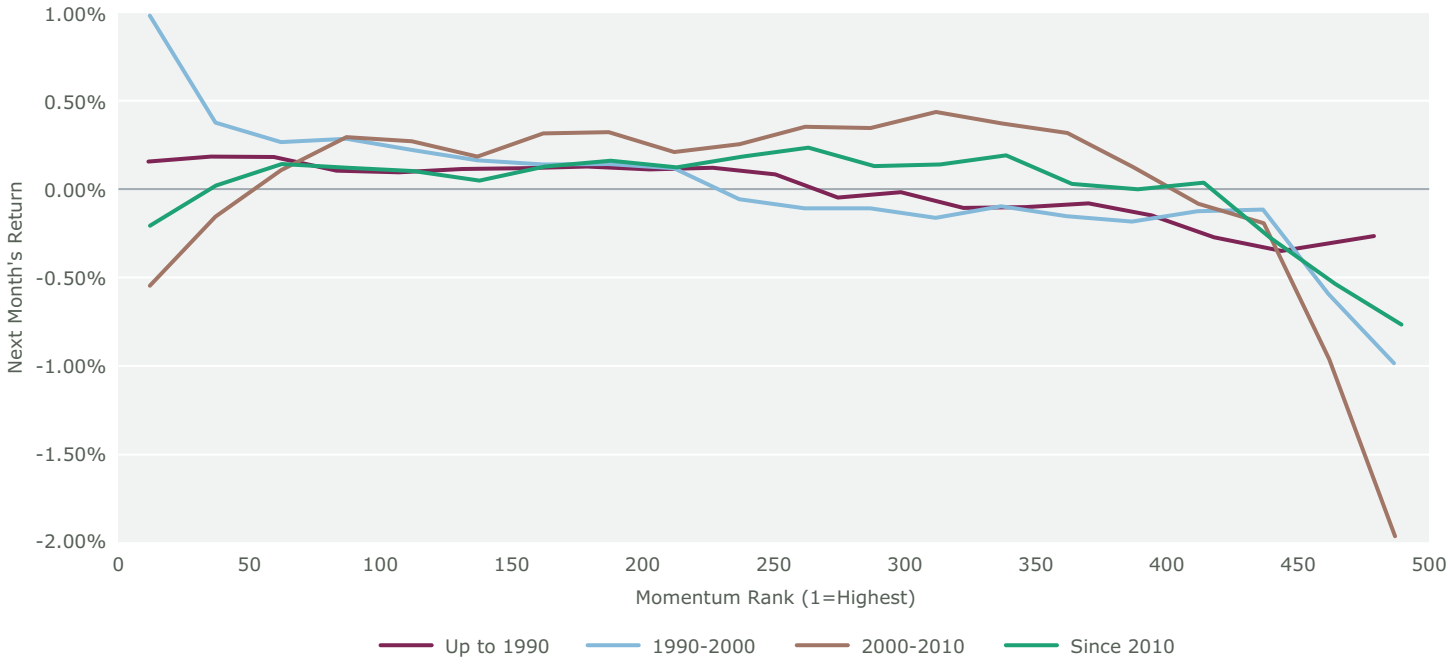
A good example of overuse is in the application of positive momentum in U.S. equities. The idea, in short, is stocks that beat the market in the past tend to continue to beat the market in the future. This approach may seem rational; however, as investor capital began pouring into these stocks, overcrowded trades ensued and interfered with the future outperformance.

Investors reacted to this by being more patient: they looked for stocks that beat the market for longer before buying them, and they held the stocks for longer before selling them for profit.

Still, the resulting overcrowding has progressively worsened so that it not only largely arbitraged the benefits of the highest-momentum stocks, but, more recently, it suppressed their returns below average.

Figure 1 plots the monthly future return of stocks in the S&P 500 ranked from highest to lowest based on momentum. Generally, stocks with the highest momentum ranks have exhibited higher monthly future returns while those with the lowest momentum ranks have exhibited the lowest, even negative, monthly future returns.[3] More recently, however, the connection between high momentum and higher monthly future returns appears more fragile.

FIGURE 1
NEXT MONTH'S RETURN OF STOCKS BY MOMENTUM RANK FOR DIFFERENT PERIODS



Source: Intech. Analyzes stocks in the S&P 500 because of the index's long historical record. Please see the appendix for momentum definition, data and methodology. For illustrative purposes only.

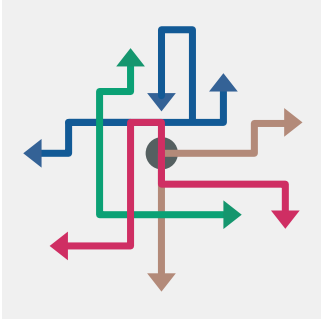
Limits in the laboratory

The second constraint that's emerged is the increased sterility of the statistical analysis used in understanding factors. When quantitative research analysts examine factors, either to "improve" their calibrations or find genuinely new ones, their research choices usually fall into one of two buckets: 1) keep it simple or 2) make it sophisticated. Both choices present challenges.

Simplicity Risks Arbitrage

This approach focuses on simple definitions of potential factors. The choice seems appealing because it's easier to understand and to implement, but the market has likely discovered these factors (or is going to in the near future) and asset managers are on the way to mining them to extinction. Consequently, they find no competitive advantage in keeping things simple.

This option may be most viable when it involves new data sources previously inaccessible to researchers. Unfortunately, in many cases, the period for which data is available tends to be so short that statistical tests are unable to establish conclusively whether the factor is genuine.



Sophistication Risks Inefficacy

This choice considers complicated definitions of potential factors that require multiple computational steps and convoluted statistical techniques. The option is appealing because the brainpower (or computer resources) required could be a competitive advantage. Unfortunately, complex factor definitions are difficult to test reliably, and investors should rigorously question their efficacy.

When there are more steps involved in defining a "winner," there are usually fewer historical examples available for testing. And, the more varied the factor definitions one tests, the more likely a few of them may appear to work well just by accident.

A better use: factors as warnings signs

The quantitative investing paradigm we've described appears to have outgrown its usefulness, not just by dramatically diluting the alpha potential it promised investors, but also by materially increasing the uncompensated risks to which they're exposed. Even investors who do not directly target factors are now subject to these systematic risks.

Ultimately, the problem is due to overcrowding: the more widely known and employed a factor, the more the factor affects your investments and your trading activity. The marketplace amplifies overcrowding by making factors convenient through simply designed smart beta products, masquerading as "passive" indices. The combination of wide accessibility and simple engineering (typically required to reduce costs), result in a greater potential for overcrowding well-known trades.

This over-the-counter approach to factor investing is particularly risky for factors in terms of performance and valuations. For example, when momentum stocks underperform the market, some momentum portfolios are likely to sell out of them (and buy the new recent winners) further depressing their prices and likely triggering a chain reaction across momentum portfolios. Similarly, if low-volatility stocks attract investors in a risk-off environment, they can become overcrowded and exhibit higher volatility, which adds insult to injury as they offer less downside protection at an increased cost.

Quantitative investors seeking to enhance their exposure to a factor through complex calibrations are still subject to most of these risks. And yet they add to the problem because their trades contribute to the uncertainty about the evolution of the factor's behavior.

> "The rest of the investor community has had to take notice of overcrowding risks, and carefully step aside when hot trades roil the markets."

This phenomenon threatens more than those who are actively trying to exploit factors. The rest of the investor community must also take notice of overcrowding risks, and carefully step aside when hot trades roil the markets. Overcrowding can pummel factor-agnostic investors: ignorance is not bliss.

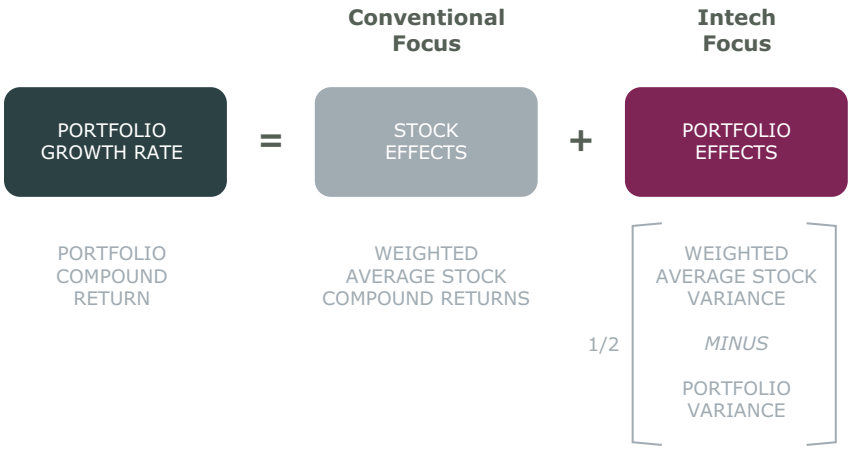
Consequently, we believe the main reason for an understanding of factors today should be less about their alpha potential and more about the risks they can exert onto your portfolio, even if you don't specifically target factor exposures.

Focus on factor interactions

A straightforward way to address these risks is to consider them, not in isolation, but in combination with each other in the portfolio. We have all long understood that a single stock cannot be more or less diversifying on its own, but only in relation to the rest of the portfolio.

The same calculus holds for outperformance. As Intech's founder discovered almost 40 years ago, we can divide portfolio growth into two parts: stock effects and a portfolio effect (Figure 2). The former reflects stocks' individual growth rates, which tend to be transient and difficult to forecast, while the latter is a simple measure of portfolio diversification. By combining complementary stocks, and thereby improving portfolio diversification (half the difference between the average stock variance and the portfolio variance), one can increase a portfolio's potential to outperform.

FIGURE 2
STOCHASTIC PORTFOLIO THEORY[13]



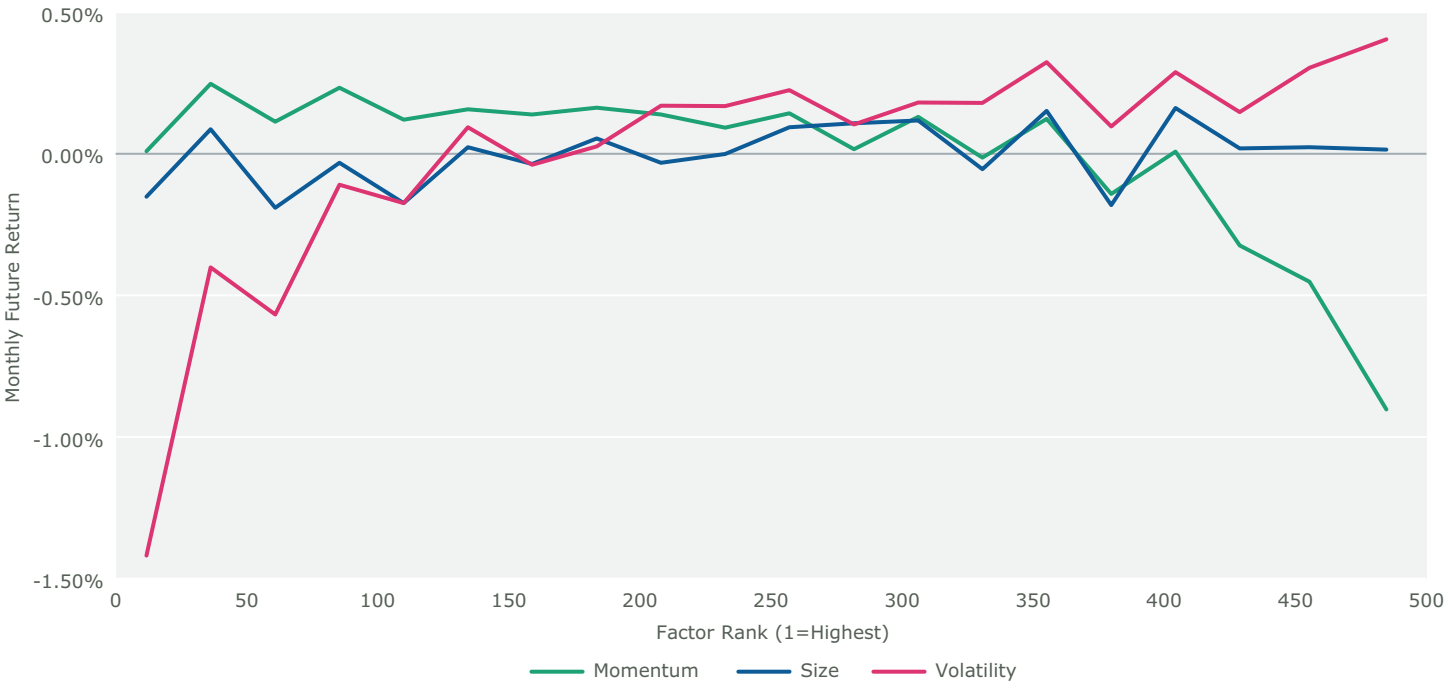
This observation holds the key to managing factor risks as well. For every factor exposure, we need to understand how much of the performance is the result of individual stock effects and how much is portfolio-level collaboration. This approach allows investors to identify the positive contributors and immunize or protect against uncompensated factor risks.

Stock and portfolio effects in action

Figure 3 illustrates the risk management approach for three common factors: momentum, size, and volatility. It plots the monthly return of stocks in the S&P 500 ranked from highest to lowest for these factors. In the case of momentum and volatility, there's a definite stock effect: avoiding the lowest (most negative) momentum stocks and highest volatility stocks should meaningfully boost the portfolio return.

FIGURE 3

NEXT MONTH'S RETURN OF STOCKS BY MOMENTUM, SIZE, AND VOLATILITY RANK



Source: Intech. Analyzes stocks in the S&P 500 because of the index's long historical record. Please see the appendix for factor definitions, data and methodology. For illustrative purposes only.

In the case of size, however, we see that there's no material dependence of the long-term return on a stock's capitalization. This observation holds for size quite generally, as long as one studies periods that are long enough to include a full market cycle.

How does our picture of the size factor reconcile with the known small-cap effect? Simple: the alpha is due to portfolio-level effects. The performance gain from increased diversification (again, an amount equal to half the difference between the average stock variance and the portfolio variance) is equal to the long-term outperformance observed for portfolios exposed to the size factor (e.g., an equal-weighted portfolio).

By repeating this analysis systematically using real-time market data, a powerful framework emerges for managing factor risk. Decomposing factor performance to stock- and portfolio-level effects allows us to understand positive exposures to the diminishing alpha potential of factors while also dynamically managing for their uncompensated risks. Together, these serve every investor's long-standing objective: improved risk-adjusted performance.

Conclusion

Uncovering the statistical biases of certain factors was an important milestone in the history of professional investing. Unfortunately, with the rapid adoption of this investing paradigm, investors haven't received clear answers to important questions about factors' rewards, risks and unintended interactions. This paper attempts to bring us more clarity.

We believe factors have moved on from being a compelling partial solution to the problem of discovering alpha, to actually causing a problem of their own – engendering systematic risks. We offer a practical framework to manage those risks.

We described the paradigm practitioners have built using factor research and two key constraints to their endeavors: 1) overcrowding which detracts from factors' alpha potential and 2) the real limits to the statistical techniques used to extend that alpha potential.

Today, a better use for factors is to help mitigate their systematic risks. These risks threaten more than just factor investors. Other investors must also take notice of overcrowding risks, and take cover when these crowded trades shake up the markets.

We propose a way to manage this growing risk: by decomposing factor performance into stock- and portfolio-level effects, we can directly measure factors' alpha potential and how it becomes arbitraged over time, while carefully managing their uncompensated risks. This two-pronged approach serves a common goal for all of us: better risk-adjusted outcomes.

Appendix

FACTOR DEFINITION FOR FIGURE 1

Momentum is the relative logarithmic total return of the stock with respect to the reconstructed index, over a period starting 252 days and ending 22 days prior to each date (inclusive in both ends).

FACTOR DEFINITIONS FOR FIGURE 3

Size is the logarithm of the reconstructed index weight. Momentum is the relative logarithmic total return of the stock with respect to the reconstructed index, over a period starting 252 days and ending 22 days prior to each date (inclusive in both ends). Volatility is the standard deviation of the absolute logarithmic total return of the stock over the previous 252 days.

DATA AND METHODOLOGY FOR FIGURES 1 AND 3

The figures in the text are based on an analysis of the stocks in the S&P 500 index over the period January 1966 through September 2019. Similar results hold for other indices, but this dataset is preferable because it offers the longest historical record of daily returns available to us.

For each factor, a score is computed for all the stocks in a reconstructed index on a daily basis using the previous historical data. The reconstructed index consists of the stocks in the S&P 500 index at the beginning of each month, with their weights propagated forward on a daily basis using the corresponding total returns (this assumes an appropriate daily reinvestment of the dividends on the ex-date).

Stocks are then ranked by their scores from largest to smallest, and their ranks and absolute logarithmic total returns for the following 21 days are collected over the entire period minus the last 21 days. Finally, the aggregate data are separated into 20 quantile groups by rank; the ranks and the returns in each group are averaged, and the average returns are further normalized to have zero mean across the 20 groups.

All historical data is based on back-testing, which is not actual performance, but is hypothetical. Back-tested data is prepared with the benefit of hindsight and is not a guarantee of future results. In addition, factor investing does not provide any assurance of improved performance or risk reduction. Exposure to such factors may detract from performance in some market environments, perhaps for extended periods. In such circumstances, a strategy may maintain exposure to the targeted investment factors and not adjust to target different factors, which could result in losses. Factor-based investing has additional unique complexities that investors should consider when evaluating expected returns.

Endnotes

1. Schwartz LM, Woloshin S. Medical Marketing in the United States, 1997-2016. JAMA. 2019; 321(1):80–96. doi:https://doi.org/10.1001/jama.2018.19320
2. Harvard Health Publishing. (n.d.). Do not get sold on drug advertising. Retrieved November 22, 2019, from https://www.health.harvard.edu/drugs-and-medications/do-not-get-sold-on-drug-advertising.
3. French, Craig W., The Treynor Capital Asset Pricing Model. Journal of Investment Management, Vol. 1, No. 2, pp. 60-72, 2003. Available at SSRN: https://ssrn.com/abstract=447580.
4. Haugen, Robert A. and Heins, A. James, On the Evidence Supporting the Existence of Risk Premiums in the Capital Market (December 1, 1972). Available at SSRN: https://ssrn.com/abstract=1783797 or http://dx.doi.org/10.2139/ssrn.1783797.
5. Ross, Stephen A. (1976). "The Arbitrage Theory of Capital Asset Pricing" (PDF). Journal of Economic Theory. 13 (3): 341–360. doi:10.1016/0022-0531(76)90046-6.
6. Banz, Rolf W. (1981). "The Relationship Between Return and Market Value off Common Stocks". Journal of Financial Economics. 9: 3–18. CiteSeerX 10.1.1.554.8285. doi:10.1016/0304-405X(81)90018-0.
7. Fama, Eugene F.; French, Kenneth R. (1992). "The Cross-Section of Expected Stock Returns". The Journal of Finance. 47 (2): 427–465. CiteSeerX 10.1.1.556.954. doi:10.2307/2329112. JSTOR 2329112l
8. Jegadeesh, Narasimhan; Titman, Sheridan (1993). "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency". The Journal of Finance. 48 (1): 65–91. CiteSeerX 10.1.1.597.6528. doi:10.2307/2328882. JSTOR 2328882.
9. Cooper, M. J., Gulen, H., & Schill, M. J. (2007). Asset Growth and the Cross-Section of Stock Returns. SSRN Electronic Journal. doi: 10.2139/ssrn.760967
10. Ang, A., W. N. Goetzmann, and S. Schaefer, 2009, Evaluation of active management of the Norwegian Government Pension Fund – Global, Report to the Norwegian Ministry of Finance.
11. Novy-Marx, Robert, The Other Side of Value: Good Growth and the Gross Profitability Premium (April 2010). NBER Working Paper No. w15940. Available at SSRN: https://ssrn.com/abstract=1598056.
12. Fama, Eugene F. and French, Kenneth R., A Five-Factor Asset Pricing Model (September 2014). Fama-Miller Working Paper. Available at SSRN: https://ssrn.com/abstract=2287202 or http://dx.doi.org/10.2139/ssrn.2287202
13. Fernholz, R., & Shay, B. (1982). Stochastic Portfolio Theory and Stock Market Equilibrium. The Journal of Finance, 37(2), 615–624. doi: 10.1111/j.1540-6261.1982.tb03584.x

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