Market Navigation

Factor Analysis/Smart Beta

FTSE Russell

Do factors carry information about the economic cycle?

Part 1: The Investment Clock: Linking factor behavior to the economic cycle

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Overview

Institutional investors are often faced with the question of which factor strategies should be implemented in different phases of the economic cycle. In this paper, we examine how factors behave across economic cycles for the US market.

- Over a long period, we find that Size and Value have anticipated subsequent inflections in GDP growth, while Quality has anticipated contractionary periods. The results are intuitive as Value and Size are more likely to do well when the outlook for the economy is good, whereas Quality provides protection when investors are more nervous about an economic decline. Momentum is found to contain little information about the macro-economy.

- We apply the Investment Clock framework to create four economic cycles based on different combinations of economic growth and inflation expectations. We find that Quality tends to do well at the peak of the cycle and continues to do so into a contraction; then, when the market hits its trough, Value, Size and Momentum tend to be the best performing factors; subsequently, Value fails, but Size and, in particular, Momentum continue to do well into an expansion.

- However, we have observed lower average factor returns since the post Global Financial Crisis (GFC) period, which was characterized by quantitative easing, and 12 years of stagnation. We will examine this phenomenon in more detail in our Part 2 report.

Contents

Introduction

We examine the behavior of factors across economic cycles [1] and secular regimes [2]. Institutional investors are often faced with the question of which factor strategies should be implemented in different phases of the economic cycle. Broadly speaking, the factors Value and Size are considered cyclical and sensitive to economic growth, whereas Quality is classified as defensive, doing well in economic downturns.

The behavior of factors across business and economic cycle has been well documented in the literature. Ferson and Harvey [3] show that much of the predicted variation of monthly excess returns of size and industry grouped stock portfolios is associated with their sensitivity to economic variables. They find, for example, that interest rate risk is important for small cap stocks.

There is academic evidence that the Fama French [4] risk factors capture shocks to economic growth expectations. Liew and Vassalou [5] examine the extent to which the profitability of Value, Size and Momentum trading strategies can be linked to macro-economic risk factors in 10 developed markets. They find that Value and Size contain significant information about GDP growth, even in the presence of other business cycle indicators for some countries. Momentum is found to contain little information about the macro-economy. Industry factors cannot explain their findings. In a more recent study, Aretz, Bartram and Pope [6] show that factor mimicking portfolios constructed based on book-to-market, size and momentum, serve as proxy composite macro-economic risk factors. They further argue that macro-economic data is often highly correlated, which can make regression results suffer from omitted variables bias. For example, a downward revision in economic growth expectations may coincide with increasing aggregate default risk and decreasing interest rates to revive the economy. They find that the Fama French Value factor captures information about shocks to economic growth expectations and the slope of the term structure, while Size captures information about shocks to aggregate default risk. Momentum captures default and term structure risk, and more weakly exchange rate risk.

Our paper builds on the academic literature as we examine if the factors—Value, Size, Momentum and Quality—convey information about the economic cycle over the past 60 years. We first test if factor returns can anticipate economic growth, as defined by GDP. We investigate if the forecasting ability has changed since the Global Financial Crisis (GFC) and its subsequent 12 years of secular stagnation. Then we combine inflation and growth expectations to construct a composite cycle indicator to create four economic cycles as defined by the Investment Clock.

The Investment Clock is based on the premise that the economic cycle moves in waves from economic growth to contraction, with central banks using monetary policy as a means of stabilizing the economy. Over the full period, factors behave as expected, but we observe an increase in the downside risk of factors since the GFC, which, in combination with less upside, has resulted in lower overall payoffs.

The Investment Clock assumes a constant or normalized economic or business cycle. The existence of a constant cycle is questionable, especially post GFC due to massive quantitative easing. An evolution of the Investment Clock is to observe a pattern of secular regime shifts. In the sequel to this paper, "New thinking: Rebooting the Investment Clock for the new normal and QE", we link factor behavior to economic regimes and identify the economic conditions most supportive of factor investing.

The paper is organized as follows: Section 1 describes the dataset and briefly summarizes the performance statistics of the factor strategies. In Section 2, we test if factor strategies can anticipate the direction of economic growth. In Section 3, factor behavior is linked to economic cycles through the prism of the Investment Clock. Section 4 summarizes the results and concludes.

1. Data and Summary statistics

Our analysis studies the behavior of factors over business cycles and economic regimes. Therefore, we need a dataset covering several market cycles. For this purpose, we use the AQR factor database, which references five long/short factors well supported by academic evidence and with the desired long history. Please refer to Appendix 1, Table 1 for a description of the AQR and Macro data used in this study. In this paper, we focus on the US, but the analysis can be extended to other regions.

Before we test for the potential link between factor returns and macro-economic growth, it is useful to measure the performance statistics of the factors to understand their distinct characteristics. Table 1 displays the statistics over the full history from January 1957 to March 2020, as well as a sub-period starting in January 2008, when the GFC started to unfold.

Over the full period, Momentum has the highest Sharpe ratio, with close to market volatility. This strategy has a negative skew and high kurtosis, indicating its returns are subject to occasional large losses. The losses were most pronounced in 1974, 2001 and 2009, reflecting market inflection points (Appendix, Graph 1). Quality has a high Sharpe ratio, with about half the volatility of the market. Value outperforms Size on an absolute and risk-adjusted basis.

Since the GFC, factors have struggled to deliver consistent performance, with the exception of Quality. For the past 12 years, the global economy has experienced a period of low growth and inflation, with markets supported by unprecedented quantitative easing from central banks. Low interest rates further punished low duration stocks, resulting in the poor performance of value stocks (from 2.6% over the full period to -2.3% since 2008). Momentum's performance has been substantially lower (from 9% over the full period to 1.7% since 2008), with an increased skew and kurtosis and maximum drawdown of 58.3% in September 2009 (Appendix 1, Graph 2 shows the maximum drawdown over the full history). We will examine the reason for this large drawdown in the next section, where we test if factors can predict future economic growth.

Table 1: Descriptive Statistics Factors: annualized monthly returns – full period and since GFC

Factors	Annualized Return		Standard Deviation		Sharpe Ratio		Skewness		Kurtosis		Lowest Monthly Return		Highest Monthly Return		Max Drawdown		Max Drawdown Period	
	Full Period	Since 2008	Full Period	Since 2008	Full Period	Since 2008	Full Period	Since 2008	Full Period	Since 2008	Full Period	Since 2008	Full Period	Since 2008	Full Period	Since 2008	Full Period	Since 2008
Market	6.22%	6.95%	15.1%	16.4%	0.39	0.42	-0.58	-0.86	1.97	1.85	-22.8%	-18.5%	16.4%	11.6%	-54.4%	-49.6%	Sep-74	Feb-09
Size	1.65%	0.12%	9.2%	8.0%	0.14	0.01	0.55	0.51	2.17	2.61	-9.1%	-7.3%	12.4%	10.6%	-54.0%	-26.7%	Mar-99	Mar-20
Value	2.63%	-2.32%	11.6%	14.1%	0.19	-0.17	0.76	1.78	8.65	13.41	-18.0%	-14.6%	26.9%	26.9%	-50.2%	-50.2%		Mar-20
Quality	4.39%	5.66%	7.9%	9.6%	0.51	0.59	0.23	0.28	3.37	1.45	-10.3%	-7.3%	12.7%	9.0%	-29.0%	-29.0%		Feb-11
Momentum	8.97%	1.69%	13.7%	17.0%	0.63	0.10	-1.51	-2.58	11.91	16.63	-34.6%	-34.6%	17.0%	11.1%	-58.3%	-58.3%		Sep-09

Note: Annualized return is the arithmetic average monthly return based on AQR US universe. Full period covers 1/31/1957 to 3/31/2020. Since 2008 period starts in 1/31/2008. Sharpe ratios use the inflation rates from Kenneth French data set. Data source: AQR and Kenneth French. Please see the end for important legal disclosures.

2. Factor payoffs during different states of economic growth

Before testing the predictive relationship between the performance of factor strategies and economic growth, it is useful to first examine how the Value, Size, Momentum and Quality strategies perform during different states of future economic growth.

Future economic growth is defined as the year-on-year growth in real GDP, reported quarterly. We associate next year's growth in GDP with the prior year's annual factor returns. Low economic growth is defined as the bottom 25% of future GDP growth outcomes; high growth as the top 25% of future GDP growth observations. The 12-month lag between GDP growth and factor returns means the GDP data starts in Q2 1958 and the factor data starts 12-months earlier in Q2 1957.

The results are shown in Table 2. The grouping creates three distinct states of economic growth. In the low state, GDP ranges from -4.1% to 2.3 %, in the medium state, 2.4% to 4.1% and in the high state, 4.1% to 9.2%.

Table 2. Grouping: Bottom 25% GDP (Low) & Top 25% GDP (High)

	GDP	Market	Size	Value	Quality	Momentum
Low	0.7%	0.2%	0.4%	0.5%	7.6%	11.5%
Medium	3.0%	6.9%	3.4%	6.2%	3.5%	4.9%
High	5.4%	12.8%	2.8%	4.1%	2.5%	9.7%
Full Period	3.1%	6.8%	2.0%	3.3%	4.5%	8.8%

Note: GDP is the quarterly year-on-year change in real US GDP over the period Q2 1958 to Q1 2020. The factor returns are quarterly annual returns from Q2 1957 to Q1 2019. Data source: AQR and Refinitiv. Please see the end for important legal disclosures.

The market factor anticipates future economic growth. Table 2 shows that both Size and Value are also positively related to future GDP growth. High portfolio returns precede periods of high economic growth. Quality shows a negative relationship with future economic growth. Higher performance precedes periods of economic slowdown. Momentum's largest average factor payoff is during periods of economic contraction, indicating it may be counter-cyclical, like Quality. However, there is also a large payoff prior to High GDP phases, making its relationship with GDP growth less clear-cut.

Daniel and Moskowitz (7) find that Momentum crashes typically occur after a prolonged bear market followed by an abrupt market upswing. A long/short Momentum strategy following a bear market will be long, low beta stocks and short, high beta stocks. Consequently, during a sudden market upswing, the high beta stocks on the short side will outperform the long, low beta stocks on the long side, causing the strategy to crash. In table 3, we show how this played out in the second quarter of 2009.

The GFC in 2008 resulted in a major sell-off in the fourth quarter with markets losing over a quarter of their value. This led to a period of economic contraction. The lowest GDP since our sample started in 1958 is -4.1%, reported in the second quarter of 2009 (right-hand panel Table 3). COVID-19 caused a much sharper contraction of -31%, discussed in part two in this series [2]. Monetary easing saw a sharp market recovery in the second half of 2009. A GDP recovery (albeit from a low base) followed in 2010.

Over this volatile period, did factor performance manage to anticipate the economic contraction in 2008 and 2009 and the subsequent recovery in 2010? Table 3 shows the quarterly factor returns between Q4 2007 and Q4 2009. We link the quarterly factor returns to the quarterly annualized GDP 12-months later.

For example, in Q4 2007, the quarterly return to Value was -8.9%. Based on the results in Table 1, we expect a negative return to Value to anticipate an economic contraction the following year. The GDP growth rate in Q4 2008 was -2.8%, confirming its negative relationship with Value.

Between Q4 2007 and Q4 2008, Market, Size and Value factor performance was negative and Quality's positive, correctly forecasting an economic contraction 12-months later. Momentum's performance was more volatile. Central bank intervention and monetary easing caused a large market recovery in Q2 2009. Momentum crashed: being long low beta stocks and short high beta stocks following the bear market resulted in a sharp loss when the market rebounded in Q2 2009. Referring to Table 2, 2010 fell in the "Medium GDP growth" phase and this may help explain why Momentum returns are lowest in this economic phase.

When we look at the factor returns predicting the GDP recovery in 2010, Size and Value turned positive in the second quarter of 2009 and Quality negative, anticipating the turnaround correctly.

Table 3: Global Financial Crisis: did factor strategies predict 2010 GDP recovery?

Factor Dates	Russell 1000	Market	Size	Value	Quality	Momentum	GDP Dates	GDP	CPI
Q4 2007	-0.2%	-3.8%	-3.9%	-8.9%	5.4%	13.0%	Q4 2008	-2.8%	1.6%
Q1 2008	-9.9%	-10.0%	0.3%	2.2%	4.4%	-0.1%	Q1 2009	-3.5%	-0.2%
Q2 2008	-2.4%	-1.3%	-2.4%	-14.6%	3.9%	16.1%	Q2 2009	-4.1%	-0.9%
Q3 2008	-9.8%	-10.2%	5.1%	10.5%	7.2%	-11.1%	Q3 2009	-3.3%	-1.6%
Q4 2008	-23.1%	-23.8%	-4.1%	-8.5%	18.7%	7.5%	Q4 2009	-0.2%	1.5%
Q1 2009	-11.1%	-9.8%	0.5%	-7.5%	5.5%	-7.3%	Q1 2010	1.6%	2.4%
Q2 2009	15.8%	18.0%	13.4%	31.8%	-11.0%	-40.9%	Q2 2010	2.7%	1.8%
Q3 2009	15.5%	16.7%	3.3%	16.5%	-12.8%	-18.7%	Q3 2010	3.1%	1.2%
Q4 2009	5.5%	5.7%	-0.1%	-2.3%	5.1%	5.1%	Q4 2010	2.6%	1.5%

Data source: AQR and Refinitiv. GDP is the quarterly year on year change in real US GDP. CPI is the year on year change. The factor returns are quarterly. Please see the end for important legal disclosures.

2.1. Can Factors anticipate inflections in the economic cycle?

In the results above, we found that positive payoffs to Size and Value have anticipated future economic growth, whereas good performance of Quality is indicative of future economic slowdowns. The relationship of Momentum with GDP is less clear. In this section, we attempt to confirm these results via regression analysis.

2.1.1 Univariate regressions: future US GDP growth on factors

We first regress the growth in real US GDP on the previous year's individual factor returns as described in equation 1. We expect the slope of the coefficients to be positive if they are able predict economic growth and negative if they can predict a downturn.

Regression 1: GDP on Single Factors

$$GDPgrowth_{(t,t+4)} = \alpha + \beta * Rf_{(t-n,t)} + \varepsilon_{(t,t+4)} \qquad \text{t= 1, …, T quarter} \qquad (1)$$

Where:

$GDPgrowth$ = year-on-year quarterly growth rate in real US GDP

R_f = annual returns to AQR's Market, Value, Size and Momentum factor

n = 4 quarters

$\varepsilon_{(t,t+4)}$ = regression residual

Table 4. Regressions of GDP growth on single factors

Panel A: Full period: Q2 1958 to Q1 2020

	Market	Size	Value	Quality	Momentum
Slope	0.04	0.04	0.02	-0.04	-0.01
SE	0.01	0.01	0.01	0.01	0.01
T-stat	5.38	2.88	1.70	-3.00	-1.47

Panel B: Q1 2007 to Q1 2020

	Market	Size	Value	Quality	Momentum
Slope	0.04	0.11	0.05	-0.04	-0.04
SE	0.01	0.03	0.01	0.02	0.01
T-stat	3.23	3.53	3.44	-2.11	-3.25

Note: Next year's growth in GDP (t, t+4) is regressed on past years annualized factor returns (t-4, t), using quarterly data. We report the regression slope, standard error and t-statistic. Source: AQR. Please see the end for important legal disclosures.

The results are shown in Table 4. Panel A shows the results for the full period. The market is a well-established indicator of future economic growth. Size has a significant positive slope and investors tend to buy these risky stocks when they expect the economy to grow. Value has a positive slope but is not statistically significant. Quality and Momentum both have a negative slope, but only significant for Quality, which can be expected to do well during an economic slowdown. Momentum has no predictive power.

Panel B focuses on the period since the GFC starting in Q1 2007 for the factor data and first predicting GDP for Q1 2008. Results are in line with the full period, but Value and Momentum are now also significant predictors of the state of the economy.

2.1.2. Multi-factor regressions: incorporating the market factor

We documented that the performance of the market, Value and Size, can predict GDP growth, whereas Quality tends to predict an economic downturn. In this section, we examine if the market is the dominant predictor and subsumes any predictive power of the other factors.

Regression 2: GDP on Single Factors plus the Market

$$GDPgrowth_{(t,t+4)} = \alpha + \beta * R_{f_{(t-n,t)}} + C * R_{m_{(t-n,t)}} + \varepsilon_{(t,t+4)} \qquad \text{t= 1, ..., T quarter} \quad (2)$$

Where:

$GDPgrowth$ = year-on-year quarterly growth rates in real US GDP

R_f = quarterly returns to AQR's Value, Size and Momentum factor

R_m = quarterly returns to AQR Market factor

$n = 4$ quarters

$\varepsilon_{(t,t+4)}$ = regression residual

Table 5. Regressions of GDP growth: Factors conditional on the Market

Panel A: Full period: Q2 1958 to Q1 2020

	Market	Size	Market	Value	Market	Quality	Market	Momentum
Slope	0.04	0.02	0.05	0.03	0.04	0.00	0.04	-0.01
SE	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
T-stat	4.79	1.69	5.79	2.68	4.37	-0.08	5.21	-0.81

Panel B: Q1 2007 to Q2 2020

	Market	Size	Market	Value	Market	Quality	Market	Momentum
Slope	0.03	0.08	0.03	0.03	0.07	0.05	0.03	-0.03
SE	0.01	0.03	0.01	0.02	0.03	0.04	0.01	0.01
T-stat	2.11	2.50	1.87	2.17	2.63	1.21	2.71	-2.74

Note: Next year's growth in GDP (t, t+4) is regressed on past years annualized factor returns (t-4, t) and past years annualized market returns using quarterly data. We report the regression slope, standard error and t-statistic. Source: AQR. Please see the end for important legal disclosures.

Table 5 shows the results anticipating annual GDP growth, conditional on information about the return on the market and the Size, Value, Quality and Momentum factor strategies. Value is significant in both periods and Size is now insignificant over the full period. Momentum remains significant only in the post 2008 period. However, the Quality factor can no longer anticipate slowdowns when conditioned on the market return.

We try to understand why Quality has no information about a downturn when conditioned on the market. First, we examine how Quality and the Market relate to future GDP growth and with each other over time. For this purpose, we first run a six-year rolling regression of GDP growth on Quality and Market returns. The results in Figure 1 show that the market coefficient is relatively stable at around 0.03. Quality conditioned on the market has a much more volatile slope and is not consistently negative. More generally, the slope coefficients of both factors have become much smaller since the GFC, which may be related to the low economic growth we have experienced since 2009.

Since 2015, Quality's coefficient has turned positive. The FAANG stocks, which score well on the Quality factor, have re-rated since 2015 and increased their market share. Has this translated into a higher correlation between Quality and Momentum? Figure 2 shows the six-year rolling correlation between Quality and Market, Size, Value and Momentum. Investors have shown a consistent preference for high Quality stocks, which has increased its correlation with Momentum since the GFC. As expected, the defensive attribute of Quality is negatively correlated with the more cyclical strategies such as Size and Value, though there are periods when they move together.

Figure 1: Six-year rolling Slope Coefficients: GDP on Quality and Momentum

Rolling slopes 1964 to Q1 2020
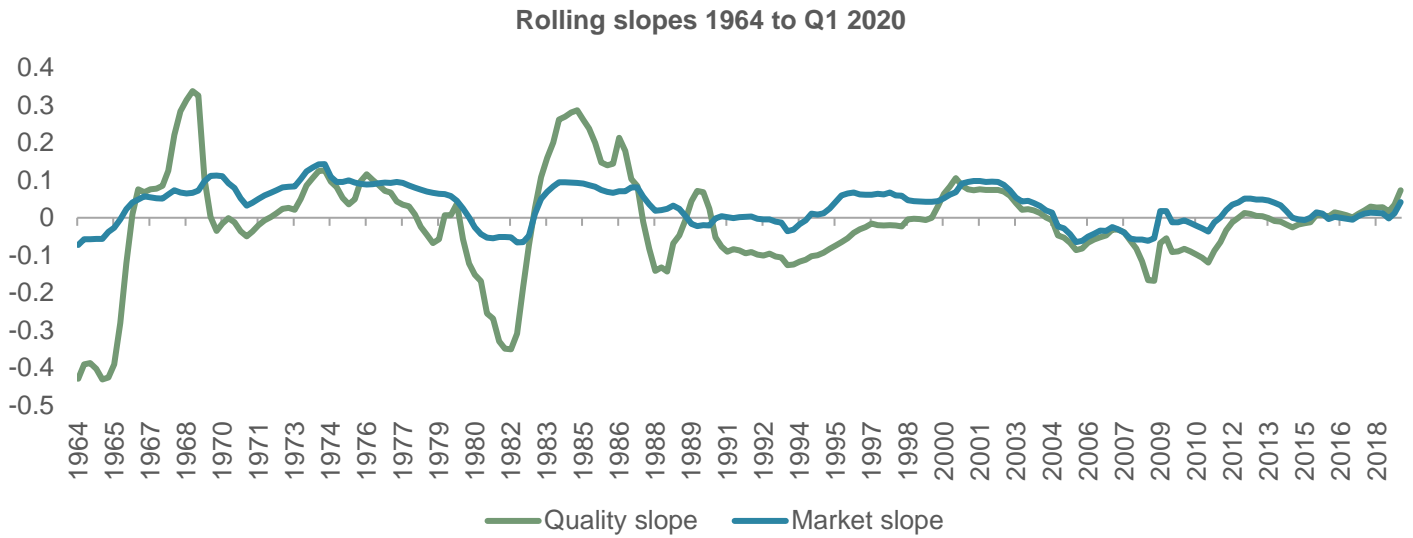
Note: 6-year rolling regression slopes based on equation (2). Source: AQR. Please see the end for important legal disclosures.

Figure 2: Six-year Rolling Correlations Quality with the Market and Factors

Rolling correlations 1964 to Q1 2020
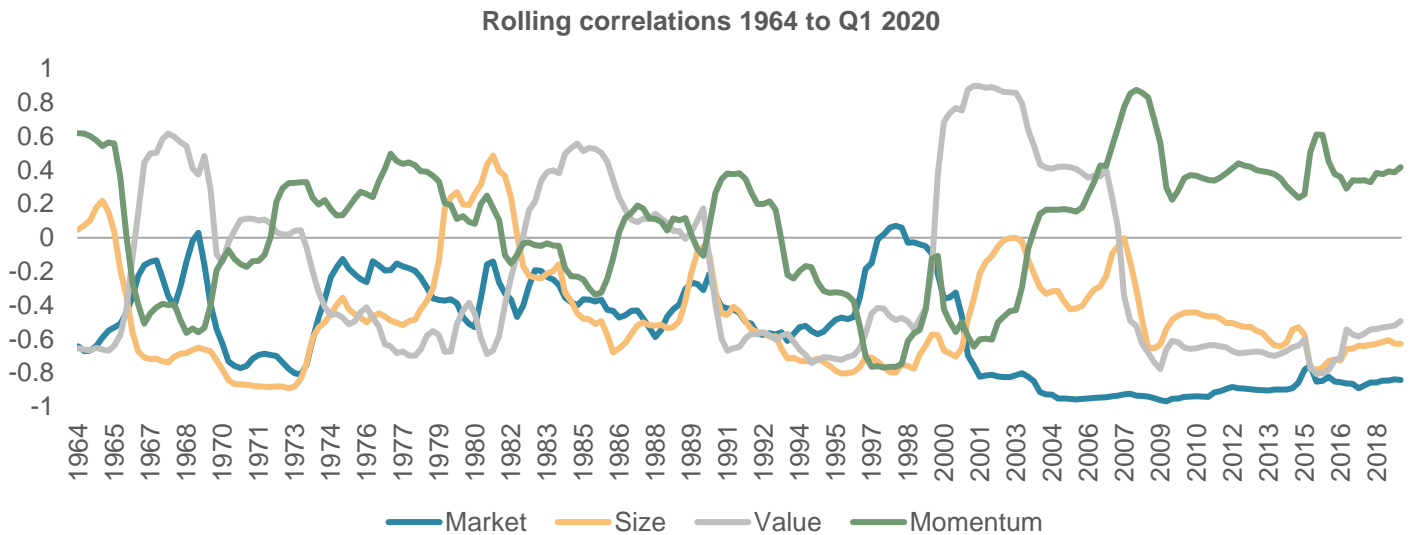
Note: Six-year rolling correlation coefficient of Quality with Momentum, Size, Value and Market. Source: AQR. Please see the end for important legal disclosures.

We have seen that financial markets respond to changes in growth expectations, but inflation expectations also play an important role in investment allocation decisions. In the next section we link the growth and inflation expectations through the prism of the Investment Clock to gain further insights in the linkage between factor returns and the economic cycle.

3. The Investment Clock: linking factor behavior to the economic cycle

The traditional Investment Clock's analysis is predicated on the notion of a discernable economic or business cycle. Its underlying principle is that the economy follows periods of expansion, overheating, cooling off and contraction with inflation picking up and then falling away when growth slows. The premise of the Investment Clock is that it maps these four macro-economic cycles to a particular asset or factor mix and tracking the clock through each of the four quadrants can guide rotation across factors as they differ in their sensitivity to real economic growth and inflation expectations as shown in Figure 3.

We will address our reservations about this approach and the existence of a constant or normalized economic cycle in the sequel to this paper [2], where we will discuss the importance of secular regime shifts on factor performance.

Figure 3. The Investment Clock: linking factor performance to economic cycles

STRONG GROWTH

Increase in ISM (3-month) and ISM > 45

HIGH/RISING INFLATION		HIGH/RISING INFLATION
3m average inflation > 3 year average inflation	Expansion · Slowdown · Recovery · Contraction	3m average inflation > 3 year average inflation

SLOWING/WEAK GROWTH

Decrease in ISM (3-month) or ISM <= 45
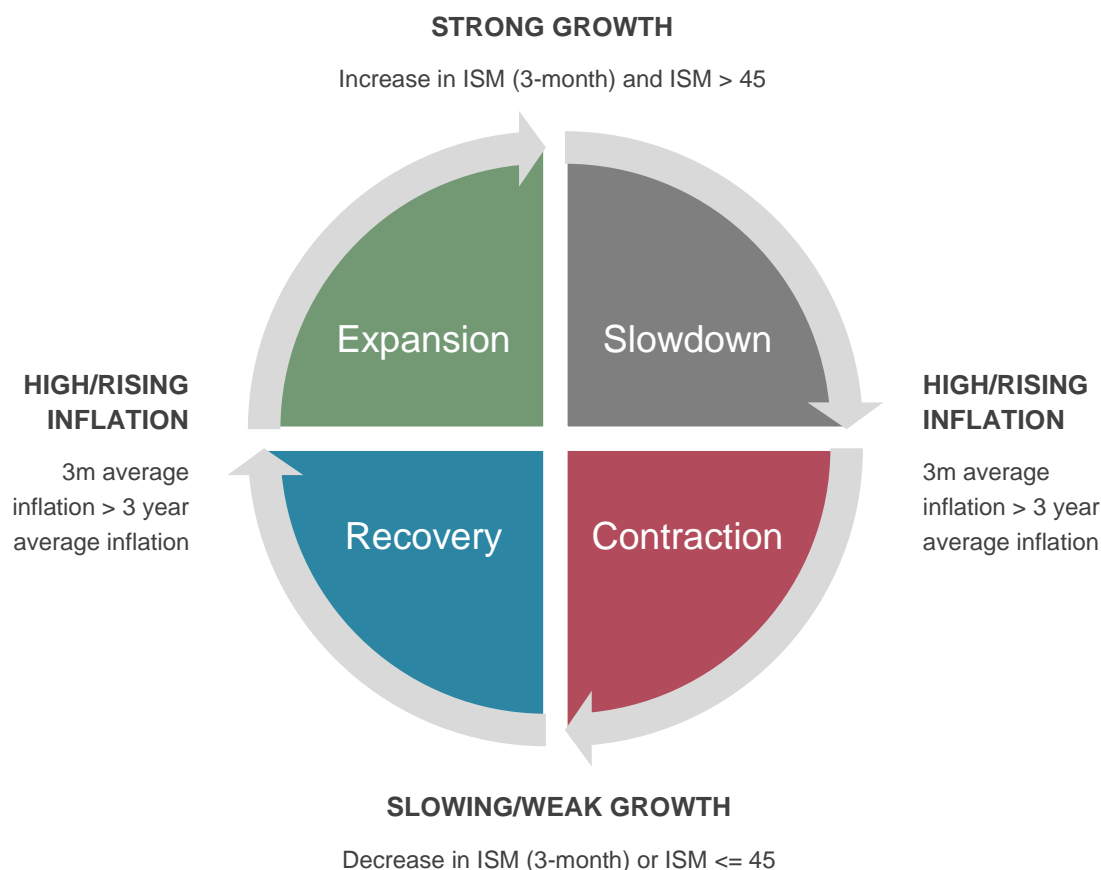
Note: The Investment Clock creates four economic regimes based on different combinations of inflation and growth expectations.

Before creating the four regimes, we first test if the factors are sensitive to inflation and growth expectations in isolation. For this purpose, we simply split our history into those months where inflation or growth expectations are up or down. Economic growth is based on the ISM manufacturing Index—a widely watched indicator of recent US economic activity. We use ISM (instead of GDP) as it is updated monthly, but the results are similar using quarterly real GDP. Markets react to an ISM reading below 50 as a sign of contraction in manufacturing and the US economy. Figures above 50 are a positive indicator of economic growth. We measure the short-term trend in economic growth by taking the three-month change in ISM. A positive change, but with an ISM reading below 45, is defined as an economic contraction.

To capture inflation expectations, we use the Consumer Price Index (CPI), a weighted average price of a basket of consumer goods and services. It is a measure of the purchasing power of a country's unit of currency and widely used to identify periods of inflation or deflation. Our inflation indicator is defined, in line with some previous studies, as the three-month change minus three-year average in inflation and captures the longer-term trend in inflation expectations.

Table 6 shows the factor performance for the full history and since 2008, as well as the difference between periods when inflation and growth expectations are up, minus when they are down. The last column shows the percentage of months spent in each of the four market phases. We now discuss the key findings for the US market and the four factors.

In line with expectations, the market reacts positively to falling inflation expectations and accelerating economic growth and this has become more pronounced since the GFC. Since 2008, the response to up-down inflation is much more negative, falling from -10.3% over the full period, to -25% post GFC. The positive reaction to economic expansion minus contraction has become highly positive, from 8.9% over the full period, to 17.5% post GFC.

Small caps (or Size) seem to do better when the economy is expanding, with up-down averaging 4.4% for the full period and 3.2% post GFC. This makes sense since small cap stocks can experience large volatility swings in declining markets, due to low trading liquidity risk and limited access to capital. The average return to up-down inflation is flat across both periods around -3.7%.

Value reacts well to falling inflation expectations: the up-down inflation differential went from -2.4% over the full period to a low -12.3% post GFC. Contradicting our earlier results that a positive return to Value is indicative of economic growth, in this simple framework Value performs better when growth expectations are falling. The up-down growth return is -3% for the full period and -5.5% post GFC. The explanation for this unanticipated result can be found in a few large rebounds in the Value factor during contractionary periods after disruptive market events. As examples, in the case of COVID-19, Value rebounded in April 2020 by 10.9%, the quantitative easing in response to the GFC led to a risk relief rally in April 2009 when value jumped up 26.9%, and in the aftermath of the TMT bubble, Value gained 11.6% in November 2002.

Quality responds well to rising inflation and falling growth expectations, displaying its defensive characteristics by providing downside protection during periods of increased market volatility. The reaction to an economic contraction is much stronger post GFC; the growth differential went from 1.8% to 10.6%. Up-Down inflation payoff did not change much, going from -4.3% to -5.5% post GFC.

Momentum over the full period has a positive performance under any scenario, with a preference for positive inflation and growth expectations. This has changed drastically post GFC, driven by the negative returns during periods when inflation or growth are down. The Up-Down inflation went from 2.6% to 16% and Up-Down growth from 5.6% to 12.8%, over the full and post GFC periods, respectively.

Table 6. Simple world: economic growth and inflation expectations rising/falling

Panel A: Q3 1957 to Q2 2020

	Market	Size	Value	Quality	Momentum	% Months
Inflation Up	1.05%	1.86%	1.45%	5.16%	9.77%	48.15%
Inflation Down	11.32%	1.77%	3.86%	3.28%	7.14%	51.85%
Growth Up	11.13%	4.15%	1.07%	1.87%	11.38%	46.69%
Growth Down	2.20%	-0.24%	4.12%	6.21%	5.80%	53.31%
Inflation Up - Down	-10.27%	0.09%	-2.41%	1.88%	2.63%	-3.70%
Growth Up - Down	8.93%	4.39%	-3.05%	-4.34%	5.58%	-6.62%

Panel B: Q1 2008 to Q2 2020

	Market	Size	Value	Quality	Momentum	% Months
Inflation Up	-5.2%	-1.0%	-8.4%	10.6%	9.4%	43.83%
Inflation Down	19.9%	2.7%	3.9%	0.0%	-6.6%	56.17%
Growth Up	17.9%	2.8%	-4.7%	0.5%	7.8%	45.06%
Growth Down	0.4%	-0.5%	0.7%	8.5%	-5.1%	54.94%
Inflation Up - Down	-25.06%	-3.68%	-12.32%	10.62%	15.97%	-12.34%
Growth Up - Down	17.48%	3.21%	-5.46%	-7.94%	12.83%	-9.88%

Note: Inflation signal = three-month average CPI – three-year average, if positive, inflation up, otherwise inflation down. ISM signal = three-month change in ISM, if positive and latest ISM >45, growth up, otherwise growth down. Source: AQR and Refinitiv.

Based on these findings, we proceed to construct a composite business cycle indicator, combining inflation and growth expectations to create four economic cycles as defined by the Investment Clock in Figure 4. For example, during periods of economic expansion, inflation and growth expectations are positive, but once the economy starts to overheat, inflation is still going up, but growth starts to falter. This can be followed by a contraction when inflation and growth are falling. Economic recovery is paired with growth picking up but inflation remaining low. The results are shown in Table 7. Risk-adjusted returns can be found in the Appendix, Table 1.

Figure 4: Investment Clock: Definition of the economic cycles
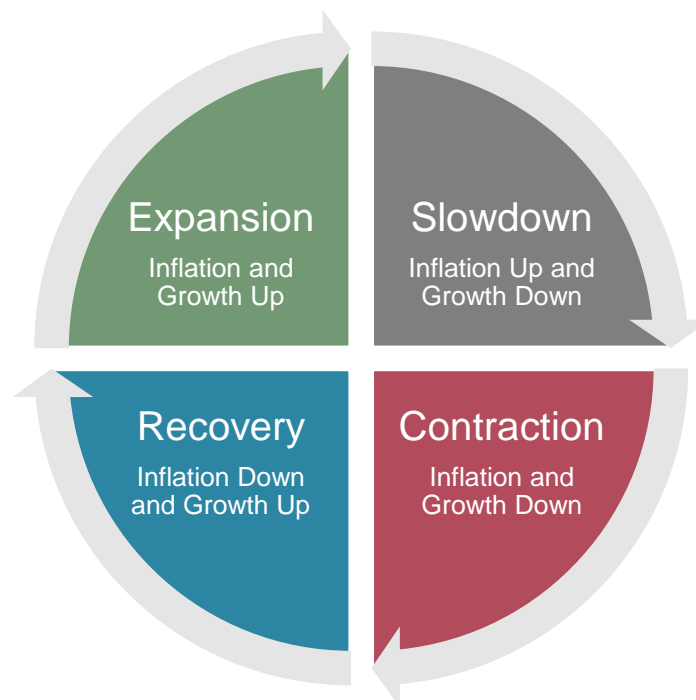
Note: the theoretical phases of the Investment Clock based on changes in Inflation (CPI) and Growth (ISM) expectations.

Table 7: Investment Clock: Factor performance over economic cycles

Panel A: Q3 1957 to Q1 2020

	Market	Size	Value	Quality	Momentum	% Months
Expansion	8.48%	3.12%	-5.44%	2.74%	14.90%	19.84%
Slowdown	-4.17%	0.98%	6.28%	6.86%	6.18%	28.31%
Contraction	9.42%	-1.61%	1.67%	5.48%	5.37%	25.00%
Recovery	13.09%	4.91%	5.89%	1.22%	8.79%	26.85%
Full Period	6.37%	1.81%	2.70%	4.18%	8.41%	

Panel B: Q1 2008 to Q1 2020

	Market	Size	Value	Quality	Momentum	% Months
Expansion	9.91%	2.65%	-13.43%	4.26%	13.78%	19.84%
Slowdown	-20.76%	-4.71%	-3.20%	17.16%	4.81%	28.31%
Contraction	15.40%	2.58%	3.53%	2.34%	-12.08%	25.00%
Recovery	26.35%	2.87%	4.52%	-3.41%	1.35%	26.85%
Full Period	8.33%	1.01%	-1.74%	4.88%	0.74%	

Source: AQR and Refinitiv. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

First, market returns have become more polarized post GFC (Jan. 2008 to June 2020) compared to the full period (Oct.1957 to June 2020). Post GFC, the US market's fall is steep during periods of economic slowdown (full -4%, post GFC -21%), compensated by a sharper recovery (full 13%, post GFC 26%). Since 2008 the market's performance has been almost 2% per annum higher relative to the full period.

Size, a cyclical strategy, picks up when the market recovers (full 3.1%, post GFC 2.7%) and continuous to perform when the economy expands (full 4.9%, post GFC 2.9%). Performance falls off when the economy slows down (full 1%, post GFC - 4.7%) and into contraction (-1.6% full, Post GFC 2.6%). It is clear post GFC the cycle was different, with stable performance around 2.6% over three cycles, but more downside during slowdowns. The strategies overall return is quite low (full 1.8%, post GFC 1% per annum).

Value, an early cyclical strategy, does well during the recovery phase (full 5.9%, post GFC 2.7%) but does not perform when the economy is expanding, especially post GFC (full -5.4%, post GFC -13.4%). We expect performance to struggle into a slowdown, which is only true post GFC (full 6.28%, post GFC -3.2%). The high performance of Value during a slowdown over the full period can be explained by the TMT bubble in the 90s, as investors paid increasingly high multiples for technology stocks, which led to a sustained period of underperformance of the Value factor. When the bubble finally burst in March 2000, a period of economic slowdown followed. Investors started buying the quality value stocks, which had been left behind, leading to a surge in the performance of Value (11.6%) during the post TMT economic slowdown. Value's performance has turned negative since the GFC (full 2.7%, post GFC -1.7%). One explanation is that long duration or growth stocks have been bid up by investors as interest rates are at an all-time low. A normalization of interest rates can potentially support value stocks as growth will be considered riskier with their expected cash flows further out in the future.

Quality performs well at the peak of the business cycle when the economy starts to roll over and investors prefer safe haven stocks, which has been more pronounced since the uncertainty investors have faced since the GFC (full 6.9%, post GFC 17.2%). These stocks continue to do well into a contraction with the possibility of evolving into a recession, with their characteristics of stable earnings and low leverage (full 5.5%, post GFC 2.3%). When the economy recovers from its contraction, Quality loses momentum (full 1.2%, post GFC -3.4%). Looking across cycles, Quality delivered a consistent positive average annual return (4.2% full, 4.9% post GFC).

Momentum, similar to the market factor, typically accelerates during periods of economic expansion, when the growth trend gets established and inflation is picking up, returning on average 14.9% (13.8% post GFC) and continuing to do well, albeit losing steam, when the economy starts to slowdown (6.2% full, 4.8% post GFC). A significant change Post GFC is a sharp sell off during market contractions (5.4% full, -12% post GFC) and barely positive, when the market recovers from its bottom (full 8.41%, post GFC 1.35%). As discussed in the first section, Momentum's worst crashes happen after an abrupt market swing following a bear market and was on the opposite side of Value during the market rebound in April 2009, losing -34.6%. Momentum's payoff has on average been much lower since 2008 (full 8.7%, post GFC 0.7%).

To conclude, we have observed an increase in the riskiness of factors since the GFC. The sell offs have been steeper for Size (during slowdowns), Value (during expansions) and Momentum (during contractions). This, in combination with less upside, has resulted in lower overall pay offs. Quality is the only factor to have maintained its overall pay off, though more polarized post GFC.

The real question is why post GFC, factors have not performed in line with the overall period? We have now gone through 12 years of secular stagnation, with quantitative easing and negative rates, dampening the business cycle. The Investment Clocks assumption, of a normalized cycle, no longer applies. The new thinking focuses on secular regime shifts to identify how factors respond to changes in the magnitude and volatility of economic indicators [2].

4. Summary and Conclusions

We examined the behavior of factors across economic cycles over the past sixty years. We first tested the relationship between the returns to factor strategies Value, Size, Quality and Momentum and future GDP. The results are intuitive. Value and Size are positively related to future economic growth. High factor returns typically precede periods of high economic growth. Quality has a negative relationship with future economic growth and can be expected to do well during an economic slowdown. We do not find any significant economic information embedded in Momentum.

We apply the traditional framework of the Investment Clock to combine economic growth and inflation expectations to identify four economic cycles: economic slowdown, contraction, recovery, and expansion. The factor payoff patterns are intuitive: during economic expansions, Momentum and Size strategies tend to do well. Quality tends to perform at the peak of the business cycle when the economy starts to roll over and investors prefer the safety of companies with stable earnings and low leverage. They continue to perform into contraction with the increased probability of a recession. When the economy recovers from its low, Size, Value and Momentum have been the best performing strategies.

The factor payoffs across economic cycles have changed since the GFC. The selloffs have been steeper for Size (during slowdowns), Value (during expansions) and Momentum (during contractions). This has not been compensated for by higher pay offs during the best performing cycles, resulting in lower overall factor returns. Quality is the only factor to have maintained its overall pay off, though also more polarized post GFC, as most of the return has been generated during slowdowns.

The traditional Investment Clock's analysis is predicated on the notion of a discernable economic or business cycle. Its existence is questionable. Quantitative easing and 12 years of economic stagnation has meant the end of the normalized cycle. The new thinking focuses on secular regimes. Part 2 [2] of this series shows how regimes have a significant impact on factor pay offs, driven by changes in the magnitude and volatility of economic indicators.

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Appendix

Table 1: Data definitions

Factor Definitions AQR Long/Short Factors

Factors	AQR Name	Data input
Market	Market	Value-weighted return on all available stocks minus one-month treasury bills
Size	SMB	Total Market Value Equity (ME)
Value	HML Devil	Book Equity/ME
Quality	Quality minus Junk	Measures of Profitability. Growth, Safety and Payout
Momentum	Momentum	12-month prior return, skipping the most recent month

Data Source: www.aqr.com, monthly data files

Macro-economic Data

Macro Data	Definition	Data Frequency
GDP	Year-on-Year quarterly US GDP rate	Annual
Inflation	Year on Year CPI, quarterly and monthly	Annual and Monthly
ISM	ISM, monthly	Monthly

Source: Refinitiv.

Graph 1: Long-term Momentum Crashes

Momentum Factor
Monthly Return 1958 to 20 to March Q1 2020
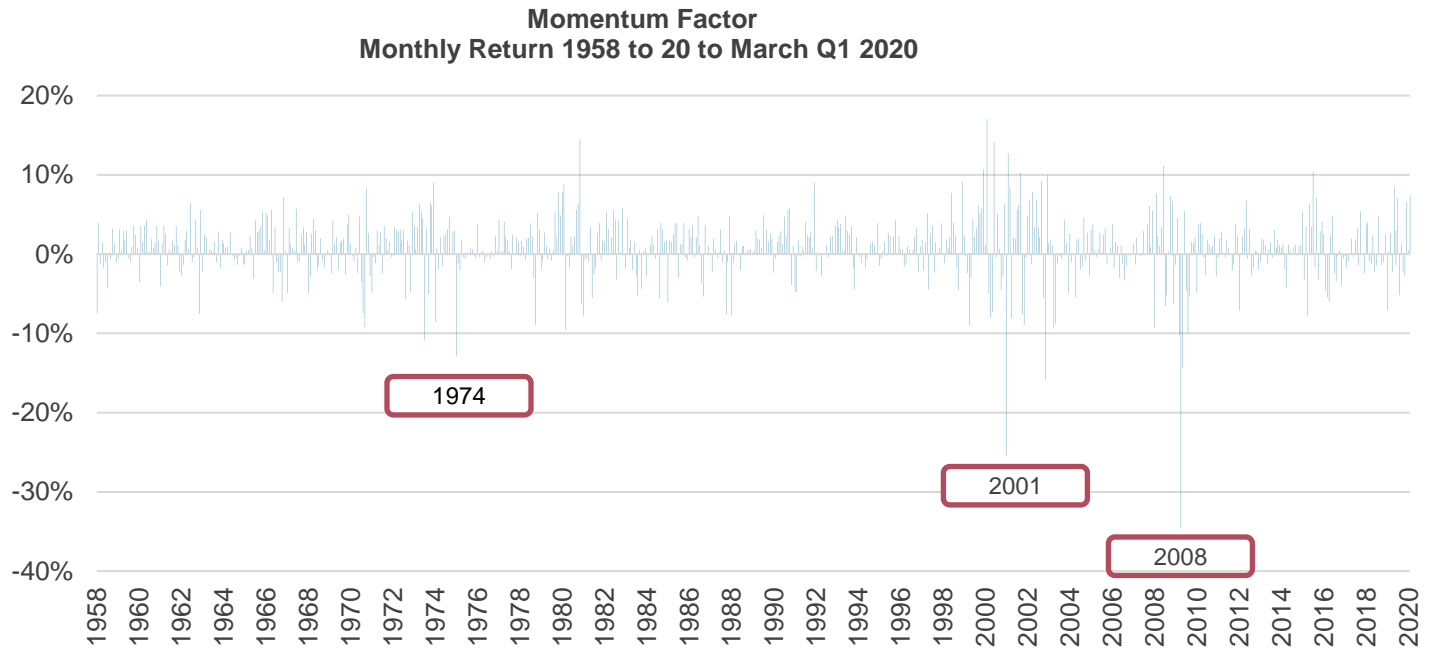
Source: AQR Momentum Factor UMD. Red circled dates in the graph indicate performance loss during market turnaround points. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

Graph 2: Maximum Drawdown Factors
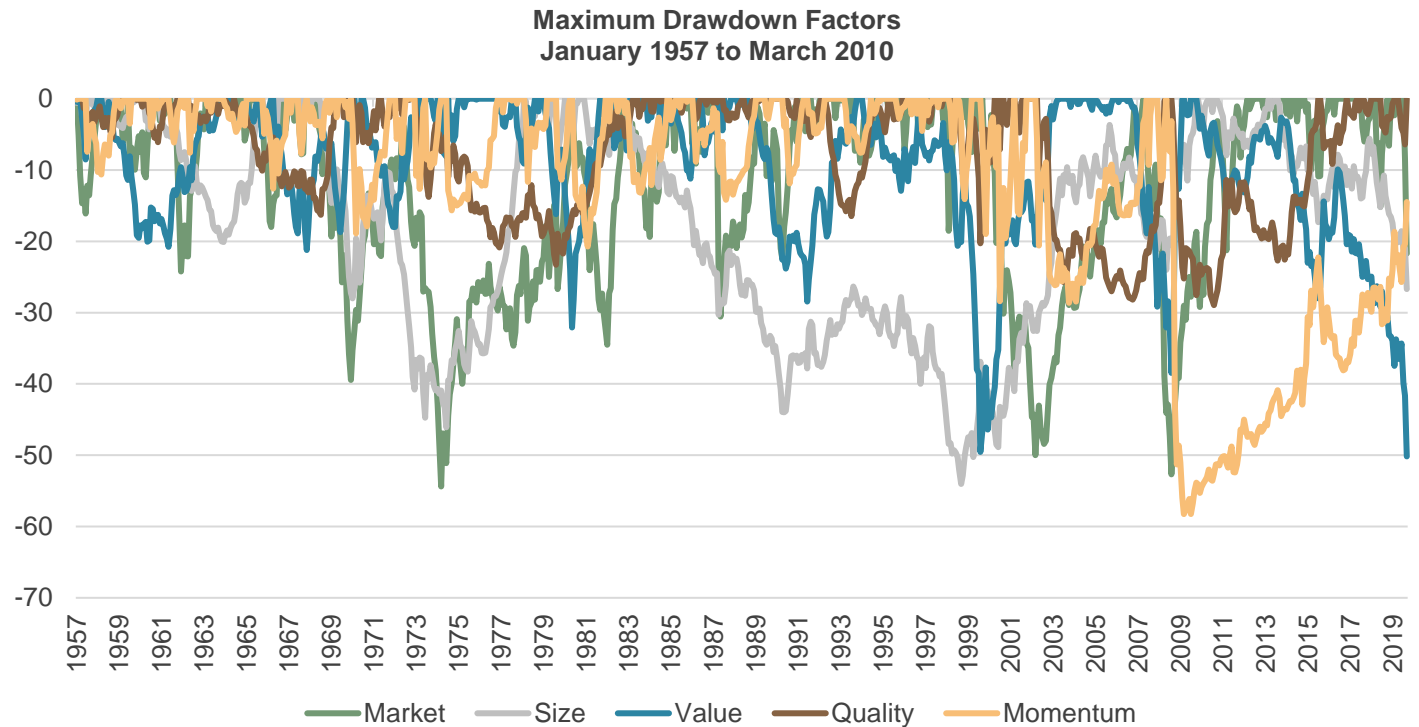
Maximum Drawdown Factors
January 1957 to March 2010

Legend: — Market — Size — Value — Quality — Momentum

Source: AQR. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

Table 1: Factor Risk-adjusted Ratios over Economic Cycles

Panel A: Full period: Q3 1957 to Q2 2020

	Market	Size	Value	Quality	Momentum	% Months
Expansion	0.55	0.34	-0.47	0.45	1.17	0.55
Slowdown	-0.25	0.09	0.48	0.71	0.40	-0.25
Contraction	0.60	-0.20	0.13	0.70	0.35	0.60
Recovery	1.11	0.22	0.30	0.59	0.81	1.11
Full Period	0.42	0.20	0.23	0.53	0.61	0.42

Panel B: Q1 2007 to Q1 2020

	Market	Size	Value	Quality	Momentum	% Months
Expansion	0.63	0.33	-0.93	0.57	0.98	0.63
Slowdown	-1.16	-0.66	-0.35	1.80	0.43	-1.16
Contraction	0.88	0.29	0.19	0.23	-0.53	0.88
Recovery	2.80	0.39	0.44	-0.40	0.11	2.80
Full Period	0.50	0.12	-0.12	0.51	0.04	0.50

Note: risk-adjusted ratios are calculated as the annualized arithmetic monthly average return divided by the annualized standard deviation. We look at the full period: September 1958 to June 2020 and since the GFC, January 2008 to June 2020.

Source: AQR. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

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