

Sector Rotation over Business-Cycles

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Abstract

Sector rotation is a widely followed investment strategy popular among professional and individual investors. Yet, despite the growth of sector investing in recent years, the question of whether or not sector rotation outperforms an investment in the market has not been previously answered. We examine the relative performance of a sector rotation strategy that follows conventional market wisdom on timing sector holdings over business-cycles from 1948-2006. We find that a sector rotation strategy guided by conventional market wisdom on where sectors provide optimal performance and with 20/20 hindsight timing business-cycles stages would have earned a 2.01% Jensen's alpha. This apparent outperformance is a best case scenario that would quickly dissipate without the benefit of hindsight and after a reasonable allowance for transaction fees. As an alternative, we show that a strategy which simply switches to cash as the business-cycle enters a recession provides superior returns to sector rotation. We conclude that, contrary to conventional market wisdom, rotating sectors over business-cycles is not an optimal investment strategy and question the widespread acceptance of sector rotation as a strategy that provides investors with relative outperformance.

JEL Classifications: E32, G10, G12

Keywords: sector rotation, business-cycles, investment strategies

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Abstract

Sector rotation is a widely followed investment strategy popular among professional and individual investors. Yet, despite the growth of sector investing in recent years, the question of whether or not sector rotation outperforms an investment in the market has not been previously answered. We examine the relative performance of a sector rotation strategy that follows conventional market wisdom on timing sector holdings over business-cycles from 1948-2006. We find that a sector rotation strategy guided by conventional market wisdom on where sectors provide optimal performance and with 20/20 hindsight timing business-cycles stages would have earned a 2.01% Jensen's alpha. This apparent outperformance is a best case scenario that would quickly dissipate without the benefit of hindsight and after a reasonable allowance for transaction fees. As an alternative, we show that a strategy which simply switches to cash as the business-cycle enters a recession provides superior returns to sector rotation. We conclude that, contrary to conventional market wisdom, rotating sectors over business-cycles is not an optimal investment strategy and question the widespread acceptance of sector rotation as a strategy that provides investors with relative outperformance.

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I. Introduction

A sector rotation strategy is based on the idea that certain sectors provide relative strength during different phases of the business-cycle. While rotating sectors across business-cycles is not a new strategy, sector rotation has witnessed a large growth in popularity as evidenced by the increasing number of sector funds introduced over the last two decades. One group of funds alone, Fidelity Select, currently offers investors a choice of 51 sector funds.¹ The growth of sector funds has ballooned in recent years particularly with the introduction of exchange traded funds (ETFs). In 2006, the number of sector ETFs available doubled from 67 to 135.² Despite growing interest in sector investing, sector rotation investors remain reliant on conventional market wisdom and anecdotal evidence for validation of the widely held view that rotating sectors across business-cycles outperforms a simple buy-and-hold-strategy. To be sure, the notion of predictable sector outperformance reoccurring at certain periods of a business-cycle is questionable from a market efficiency perspective.

This study investigates if a sector rotation strategy guided by conventional market wisdom on the sectors to hold across business-cycles generates additional alpha returns. Given the sizable amount of investment capital sector rotation attracts, we believe that documenting whether or not sector rotation consistently provides risk-adjusted outperformance will be of broad interest to both professional and private investors. Additionally, evidence of a systematic and predictable connection between sector returns

¹ <http://personal.fidelity.com/products/funds/content/sector/products.shtml>

² Investment Company Institute, 2007. *Investment Company Fact Book* (Investment Company Institute).

and business-cycle movements would indicate anomalous market behavior and be of potential interest to financial researchers.

The results of our study indicate sector rotation does not generate risk-adjusted returns in excess of the market. We cover the period 1948-2006 with NBER defined phases of expansion and recession divided into smaller sub-periods to coincide with business-cycle stages where the market expects optimal sector performance.¹ We find that a sector rotation investor guided by conventional market wisdom and with 20/20 hindsight timing business-cycles stages would have only realized a marginal 2.1% Jensen's alpha. This marginal outperformance is a best case scenario that comes before any allowance for transaction fees and with the benefit of perfect hindsight. More realistically, it would seem extremely difficult for a real-time investor to correctly time sector investments across all business-cycle stages as required to systematically outperform the market.

As an alternative to sector rotation, we also consider a much simpler market-timing strategy that is continually invested in the market excluding the first half of a recession. Market-timing investors would only need to anticipate one stage of the business-cycle and incur only one-fifth the transaction costs of a sector rotation strategy. For the same 1948-2006 period, a market-timing investor would have realized a slightly higher terminal wealth and higher Sharpe ratio compared to a sector rotation investor. This comparison illustrates that sector rotation would not be the optimal strategy, even for an investor with the ability to correctly anticipate business-cycle conditions. We conclude

¹ See DeStefano, Michael, 2004, Stock Returns and the Business Cycle., *Financial Review* 39, 527-547. for an example of this methodology.

that, contrary to conventional market wisdom, rotating sectors over business-cycles is not an optimal investment strategy and question the widespread acceptance of sector rotation as a strategy that provides investors with relative outperformance.

Our contribution to the literature is twofold. First, we believe our study is the first to empirically document the performance and relative strength of sectors over the course of a business-cycle. We find actual sector performance largely fails to align with the expectations of conventional market wisdom. Secondly and more critically, we show that contrary to conventional wisdom and despite the popularity of sector rotation among investors, a sector rotation strategy yields only marginal outperformance that is inferior to a much simpler market-timing strategy.

Our study is organized as follows. Section II provides an overview and discusses the relevant literature. Section III describes business-cycles. Section IV examines the performance of sectors over business-cycles. Section V documents the performance of a sector rotation strategy with terminal wealth estimations. Lastly, section VI concludes our analysis.

II. Overview

The basic notion of sector rotation is that different economic sectors predictably and systematically under or over-perform the market at different points in a business-cycle. Moreover, sector rotation investors believe the relative performance of sectors moves

sequentially from one sector to the next over the course of a business-cycle.¹ The profitability of timing sector holdings across business-cycles is an idea entrenched in conventional market lore and widely supported by the financial press. For instance, conventional wisdom holds "if you are in the right sector at the right time, you can make a lot of money very fast."² The challenge for sector rotation investors in outperforming the market is to both correctly select sectors and correctly time the business-cycle - a daunting task for even the most astute investor.

The financial press provides abundant advice to investors on timing sector investments with business-cycles. For instance, a CNN Money article warns against the implication of an economic slowdown on sector returns after a pause in Federal Reserve Bank interest rate hikes. The same CNN article further suggests pharmaceuticals, financials, consumer staples and utilities provide optimal performance in recessions.³ A popular investment webpage similarly advises "when the economy cools off, cyclical companies are hit hardest" and that "defensive stocks experience profit irrespective of business-cycle phases."⁴ Conventional market wisdom holds that cyclical industries provide the greatest relative strength when the economy first enters a period of expansion.⁵ In his widely followed practitioner guide "Sector Investing," Stovall (1996) catalogs where sectors are believed to provide investors with the highest returns over different stages of economic expansion and recession.

¹ Fidelity Investments, 2007, Sector Education, (Fidelity Investments).

² <http://www.nowvest.com/> Peter Lynch in Beating the Street

³ http://money.cnn.com/2006/08/08/markets/fed_pause_stocks.moneymag/index.htm

⁴ <http://www.investopedia.com/terms/d/defensivestock.asp>

⁵ Business Week Online, 2002, Get In, Get Out, and Move On, (McGraw-Hill Companies, Inc.).

Nonetheless, while conventional market wisdom abounds, until now prior empirical research has yet to document if sector rotation is actually a viable investment strategy. Indeed, market efficiency theory suggests earnings fluctuations that result from reoccurring business-cycle fluctuations should not influence short-term returns. If there is a pattern in sector returns, as sector rotation investors believe, this predictability is at odds with basic assumptions of market efficiency. There are several possible explanations for what might cause this anomalous market behavior.

Within an efficient markets framework, asset prices might be influenced by changing fundamental values related to fluctuations in macroeconomic determinants. Short-term, cyclic returns are possibly explained by changes in expected fundamental values correlated with economic conditions. An early study by Fama and French (1989) finds that stocks and bonds contain a term premium that coincides with business-cycle peaks and troughs. Chordia and Shivakumar (2002) and more recently Avramov and Chordia (2006) confirm that priced factors such as firm size, value, and momentum are correlated with variables known to track business-cycles.

The conclusion that sectors perform unequally or exhibit a lead/lag relationship across business-cycles is found in several studies. Hou (2007) find a lead/lag effect in sector response to the arrival of new economic information. Hong, Torous and Valkanov (2007) and Eleswarapu and Tiwari (1996) observe that sectors with a strong link to economic

activity such as the retail, metals, services, and petroleum sectors lead the market by as much as two months. Menzly and Ozbas (2004) show that the timing of industry profits relate to its position in the production/consumption supply chain with a persistent lag relationship exists between returns to upstream and downstream industries. This upstream and downstream relationship is also seen to hold by Stovall (1996) who observes that basic materials are the first industry to emerge from a recession followed in turn by manufacturing. Stovall (1996) finds that industries related to end-user consumption, such as consumer durables, are the last industry to recover from a recession.

The question largely remains unanswered if sector rotation investors have historically outperformed the market. The limited empirical research on the profitability of sector rotation strategies provides conflicting results. A study of sector fund returns by Sasseti and Tani (2003) concludes that in the medium-term sector switching is a profitable strategy. However, they also find a long-horizon investor is still better off investing in a market index. In contrast, Tiwari and Vijh (2005) question the ability of investors to profitably rotate funds from one sector to another. Their findings based on sector fund data from 1972-1999 show sector investors lack both selection and timing ability and are unable to earn excess returns after correcting for risk and deduction of transaction fees.

In summary, the viability of sector rotation as an investment strategy remains something of an enigma. Widely held conventional wisdom suggests a strategy which rotates sectors dependent on the phase of a business-cycle can generate excess returns for investors.

Anecdotal evidence from financial practitioners supports the idea of a correlation between sector performance and business-cycle conditions. However, there has been only scant research in this regard. The literature does document evidence of cyclical patterns in asset returns that is influenced by macroeconomic variables. Other studies document a lead/lag relationship between sectors that could result in unequal sector performance across business-cycles. Even assuming a systematic relationship between sector and business-cycles exists, sector investors must still correctly time sector investments with business conditions. The ability of sector rotation funds to systematically outperform the market seems questionable based on the results of some studies. In the analysis which follows, we endeavor to address the question if an investor who rotates sectors across business-cycles can outperform the market. However, first we discuss stages of a business-cycle and define our timing variables.

III. Business-cycles

Sector rotation requires the correct timing of sector investments with different stages of the business-cycle. The idea of accurately predicting business-cycles has been the bane of econometricians and financial researchers for years. The official government agency responsible for dating business-cycles in the U.S. is The National Bureau of Economic Research (NBER). The NBER merely tracks cycle turning points (peaks and troughs) and can take as long as two years *after* the economy changes direction to publish cycle dates. Consequently, real-time investors are unable to benefit from this information. However, for the purpose of our study NBER defined business-cycle dates provide a necessary framework for the analysis of sector rotation.

While the NBER defines broad phases of economic expansion and recession, common practice is to divide cycle phases into smaller sub-periods in order to better observe asset sensitivity to business-cycle dynamics. DeStefano (2004) divides cycles into two stages of expansion (early/late) and two stages of recession (early/late). Stovall (1996) further divides longer periods of expansion into three stages (early/middle/late). This convention is more aligned with common practice. We follow Stovall (1996) and partition NBER dated phases of expansion into three equal stages (early, middle, and late) and recessions into two equal stages (early and late). Figure I illustrates a stylized business-cycle with phases of expansion divided into three stages and phases of recessions into two. This study uses the five business-cycle stages as shown in Figure I for analysis of sector performance and the timing of a sector rotation strategy.

[Please insert Figure I]

Our study covers nine complete business-cycles over the period December 1948 to December 2006. The last published NBER turning point was the economic peak dated March 2001. To utilize all the available data, we divide the ensuing 61 month period of our study into early expansion (30 months) and middle expansion (31 months). We make the assumption that the economy enters the late stage of expansion starting in 2007

largely based on a survey of professional forecasters by the Philadelphia Federal Reserve.¹

Panel A of Table I reports business-cycle peak and business-cycle trough reference dates published by the NBER. Additionally, the duration of business-cycles counted from peak to peak is shown. While business-cycles have lasted an average 70 months in the years since 1948, they exhibit a great deal of variability in duration with earlier business-cycles much shorter than more recent ones.

In Panel B business-cycles are further divided by three stages of expansion and two stages of recession. We count the total length of a recession to be from the first month following a cycle peak to the subsequent cycle trough date. Periods of expansion are counted to be from the first month following a cycle trough to subsequent cycle peak date. From Table I we observe that expansions last on average approximately five years and recessions less than one year. The average duration of expansions, recessions, and business-cycle stages are shown at the bottom of Panel B.

[Please insert Table I]

The starting point of our sample is motivated by two considerations. First, restricting our sample to post 1948 eliminates any possible business-cycle distortions caused by the

¹ see Philadelphia Federal Reserve Bank, 2007, Survey of Professional Forecasters, (Philadelphia Federal Reserve Bank).

Great Depression or World War II.¹ For instance, although the US economy was officially in a depression during 1945, industries were still operating at full war time production. Second, we start our sample from 1948 as several studies suggest business-cycles are arguably different in the years since WWII. For instance, Fama (1975) finds business-cycle length and amplitude change subsequent to adoption of the 1951 Federal Reserve Accord. The 1951 Accord allows the Federal Reserve Bank to moderate business-cycle fluctuations through interest rate adjustments. Consequently, the adoption of counter-cyclical policies in the years since 1948 has resulted in different business-cycle dynamics from earlier years.

We construct business-cycle timing variables based on the sub-periods of economic expansions and recessions. Our five business-cycle stage dummy variables S_{jt} take the value one or zero conditional at time t on the current stage of the business-cycle. Dummy variables S_{1t} through S_{3t} correspond with the three stages of economic expansion (early/middle/late). Dummy variables S_{4t} and S_{5t} correspond with the two stages of economic recession (early/late).

¹ See for example Chatterjee (1999) and Cover, James P., and Paul Pecorino, 2005, The length of US business expansions: When did the break in the data occur?, *Journal of Macroeconomics* 27, 452-471.)

IV. Sector Performance

Our data is well known monthly industry returns, market returns, and Treasury-bill rates from 1948-2006 obtained from the Kenneth French website.¹ Market returns represent the total value weighted returns on all NYSE, AMEX, and NASDAQ stocks. The one-month Treasury-bill from Ibbotson serves as a proxy for the risk-free interest rate. 48 value weighted industry portfolios are formed by CRSP and Compustat SIC classifications. All return data is described in further detail on the Kenneth French website.² For clarity of interpretation, continuously compounded monthly returns in excess of the risk-free rate are reported as annualized percentage points.

[Please insert Table II]

In Table II we show the business-cycle stage where sector outperformance is documented by a popular practitioner's guide (Stovall, 1996). It is of interest to note that Stovall (1996) simply observes nominal returns without any risk adjustment. Nonetheless, the assignment of sectors to these business-cycle stages largely tracks conventional market wisdom and is widely followed by investors and popular mutual funds.³ Each of the 48 industries in our study is assigned to a unique business-cycle stage corresponding with the appropriate sector. Stage I (early expansion) has two sectors with a total six

¹ http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_49_ind_port.html

² http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library

³ See for example <http://personal.fidelity.com/products/funds/content/sector/basics.shtml.cvsr>

industries; Stage II (middle expansion) has two sectors with a total twelve industries; Stage III (late expansion) has two sectors with a total ten industries; Stage IV (early recession) has two sectors with a total two industries; and lastly Stage IV (late expansion) has two sectors with a total eighteen industries. The total number of industries included in each business-cycle stage range significantly from two in Stage IV to eighteen in Stage V with important implications for comparable diversification across periods.

We now observe summary statistics for the entire 1948-2006 sample period and also conditional on the stage of the business-cycle from our basic model equation (1)

$$r_{it} - r_{ft} = \sum_{j=1}^5 \alpha_j S_{jt} + \varepsilon_t \quad (1)$$

where excess industry returns $r_{it} - r_{ft}$ are the difference between nominal industry returns and the one-month Treasury-bill and the S_j 's are business-cycle timing variables as described earlier. The α_j 's can be interpreted as industry returns conditional on the stage of the business-cycle. The error term (ε_t) is a white-noise error term with White (1980) heteroskedasticity consistent standard errors.

Table III reports average returns, standard deviations, and beta coefficients for all 48 industries, the market index, and Treasury-bills. Industries are grouped by the business-cycle stage expected to provide optimal performance.¹ Returns are then sorted from highest to lowest beta within each group. The total number of observations for the entire period and each business-cycle stage are shown at the top and observations by industry are shown on the left-hand column of Table III. Note that all but five industries span the full sample period. The exceptions are the fabricated products, precious metals, defence, and healthcare industries which start in July 1963 and computer software industry which started in July 1965.

[Please insert Table III]

We first look at summary statistics for the market and Treasury-bills. The market averages a 7.1% return for the entire period with the highest return occurring during Stage V (34.9%) and lowest return occurring during Stage IV (-22.8%). This represents a sizable 57.7% difference in market returns between the beginning and end of recession. This is all the more remarkable considering recessions last on average less than one year. Similarly, DeStefano (2004) observes that returns to the S&P 500 are highest across all business-cycle stages during late recessions. In contrast with market returns, market

¹ See for example Stovall (1996), Sam Stovall's Sector Watch http://www.businessweek.com/investor/list/stovall_toc01.htm, and Fidelity Sector Funds at <http://personal.fidelity.com/products/funds/content/sector/basics.shtml.cvsr>

volatility as measured by standard deviation, is relatively stable across business-cycles with an average 14.5% for the entire period and a range from a low of 12.8% in Stage I to a high of 18.2% in Stage V. Predictably, the highest Treasury-bill rates (6.4%) are observed during Stage IV and the lowest (3.8%) during Stage I. Treasury-bill rates are a key economic indicator that track Federal Reserve monetary policy. These rates show an expected monotonic increase from early expansion to early recession but then decrease during late recession.

Industry returns exhibit the same pattern as market averages with virtually all returns lowest during Stage IV and highest during Stage V. The tobacco industry has the only positive return (0.6%) with the lowest beta of all industries as the economy enters a recession in Stage IV. When we look further at industries, the highest volatility of returns occurs for 10 industries in Stage IV and 36 industries in Stage V. Twenty-five industries experience their lowest volatility during Stage II. A possible explanation for the overall low volatility found during the middle period of economic expansion is the relatively stable industry earnings which occur between the rapid growth typical of early expansions and decelerating growth typical of late expansions. Unequal sector volatility across business-cycle stages is perhaps related to differences in earnings that might reflect an upstream/downstream effect as previous studies document.

We also investigate industry betas as a measure of relative market risk. The communications sector (0.72) and utilities sector (0.54) are regarded by the market as

recession hedges and have among the lowest overall betas for the entire period. Not surprisingly, the computer software industry (1.78) has the highest overall beta. The lowest beta for all business-cycle stages is the utilities sector (0.33) in Stage V and highest is the computer software sector (2.37) in Stage IV. There is some apparent clustering within business-cycle stages with maximum betas for 14 industries occurring in Stage V and minimum betas for 18 industries occurring in Stage III. Generally there appears to be no pattern across cycle stages where certain sectors exhibit the highest relative risk. Rather, industry minimum and maximum betas appear largely dispersed over the entire business-cycle. To surmise, no strong correlation appears between industry betas and the business-cycle stage where they are expected to provide relative outperformance. The clear exceptions are the telecom and utility sectors in Stage V.

Overall the investigation of nominal returns indicates that actual industry performance across business-cycle stages partially aligns with what is expected by conventional market wisdom from Table II. Those sectors selected for late expansion, early recession, and late recession succeed in outperforming the market. For instance, in early recession the sectors considered optimal for that period (utilities and telecom) show an average return of -7.6% as compares with an average -30.4% return for the worst performing sectors (technology and transportation). This is a relative outperformance of 38.0% between the best and worst performing sectors for that stage. For the two remaining periods, early and middle expansion, sector averages are within a much narrower range.

We are also interested in observing if there is a significant difference in nominal returns within industries across business-cycle stages. The right-hand column of Table III reports p-values from a Wald test of joint significance with alphas obtained from our conditional business-cycles model (eq.1). Our null hypothesis is no difference in industry returns between the five business-cycle stages. If industry returns are constant across business-cycle stages then differences in means should be statistically indistinguishable from zero. The null hypothesis is formally stated:

$$H_0 : \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5$$

$$H_1 : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5$$

with α_j 's nominal industry returns conditional on each of the five business-cycle stages as obtained from our basic model (eq.1). Based on the results of a Wald test of joint significance, we reject the null hypothesis of constant returns. Under the null hypothesis, p-values are under 10% and close to zero for all but two industries. The exceptions are computer software and precious metals. A possible explanation for these two exceptions is the loss of statistical power due to the shorter sample size of these industries. We can conclude from the Wald test that industry returns are not equal over the course of a business-cycle.

Table IV compares Sharpe ratios and Jensen's alphas for industries across business-cycle stages. The Sharpe ratios provide a comparison of excess industry returns relative to risk. Jensen's alphas provide a measure of industry returns in excess of the risk-free rate and adjusted for systematic market risk. Conditional Jensen's alphas are obtained as the intercept terms from our modified CAPM model equation (2) as follows:

$$r_{it} - r_{ft} = \sum_{j=1}^5 \alpha_j S_{jt} + \sum_{j=1}^5 \beta_j S_{jt} (r_{mt} - r_{ft}) + \varepsilon_t \quad (2)$$

where excess industry returns $r_{it} - r_{ft}$ are the difference between unadjusted industry returns and the one-month Treasury-bill and S_j 's are business-cycle timing variables as described earlier. The α_j 's can now be interpreted as Jensen's alphas conditional on the stage of the business-cycle. A positive and statistically significant Jensen's alpha indicates risk-adjusted market outperformance. Under a null hypothesis of no outperformance, the Jensen's alphas should be statistically indistinguishable from zero. We report Jensen alphas as annualized percentage points for clarity of interpretation. Corresponding t-stats are based on White heteroskedasticity consistent standard errors, (White, 1980). Sharpe ratios are calculated as industry returns in excess of the Treasury-bill rate divided by the standard deviation of industry returns. Industries are grouped by the business-cycle stage considered optimal according to widely held conventional

market wisdom.¹ Returns are then sorted from highest to lowest Sharpe ration within each group.

[Please insert Table IV]

A look at Jensen's alphas reveals several interesting results. In Stage I we observe approximately 60% of industries have negative alphas. Contrary to conventional wisdom, of the six industries in the technology and transportation sectors that are expected to outperform in Stage I, only two (shipping containers and general transportation) have positive alphas. All industries in the technology sector have particular large negative alphas. Automobiles (7.0%) have the highest Jensen's alpha during early expansion although consumer cyclical industries are not expected to show relative strength until Stage V. On average, all Stage II sectors (capital goods, basic materials, services sectors) underperform the market. Aircraft (3.9%) and electrical equipment (2.7%) industries provide the best outperformance while shipbuilding (-5.8%) and personal service (-4.1%) provide the worst. The realized outperformance of Stage III sectors largely aligns with market expectations. Only one industry (candy and soda) underperforms the market. Notably, the energy sectors (coal and petroleum) provide good overall outperformance during Stage III. The two Stage IV sectors, communication (5.7%) and utilities (13.3%),

¹ See for example Stovall (1996), Sam Stovall's Sector Watch http://www.businessweek.com/investor/list/stovall_toc01.htm, and Fidelity Sector Funds at <http://personal.fidelity.com/products/funds/content/sector/basics.shtml.cvsr>

also significantly outperform the market. In particular, utilities are the strongest Stage IV performer with only 18 industries providing outperformance. Most industries also perform as anticipated during late recession. Several consumer durable industries, apparel (17.1%) and printing (15.4%), perform exceptionally well. However, unexpectedly it is the Stage III sectors (consumer staples and energy) that as a group provide the best Stage V performance and not the expected sectors (consumer cyclical and financial) with Jensen's alphas of 9.7% and 4.8% respectively.

Overall, our results provide limited evidence that sectors provide relative strength during the business-cycle stage that is predicted by conventional market wisdom. Results for early and middle expansion suggest investors are better off in the market than sectors. Late expansion and early recession industries perform largely as expected. While in late recession the results are mixed.

As an additional step, we observe industry Sharpe ratios as a measure of sector/industry performance from a risk/return trade-off perspective. Stage I sectors (technology and transportation) have a substantially lower average Sharpe ratio than the market at 0.14 and 0.26 respectively. Sectors expected to provide relative Stage II strength also underperform the market on average although only marginally. Electrical equipment (0.21) is the sole industry of those expected to provide relative Stage II strength that outperforms the market. Looking at the remainder of industries during middle expansion, those in the consumer staples sector provide the best Sharpe ratio outperformance. Sharpe

ratios for sectors expected to provide Stage III and Stage IV outperformance align with market expectations. Notably, tobacco (0.01) is the only industry with a positive Sharpe ratio during Stage IV. Capital goods is the overall worst performing sector as the economy enters a recession with fabricated products (-0.64) the worst industry. Lastly, only five of eighteen industries expected to provide relative strength during Stage V realize higher Sharpe ration than the market. Although nominal industry returns are mostly higher than the market during Stage V, investors using Sharpe ratio as a metric are actually better off invested in the market during this period.

As a final evaluation of sector performance, we conduct a Wald test to observe if there is a significant difference in risk adjusted industry outperformance across business-cycle stages. The right-hand column in Table IV reports p-values from a Wald test of joint significance for Jensen’s alphas obtained from our conditional business-cycle model with a market correction (eq.2). Our null hypothesis is no difference in industry returns between the five business-cycle stages. If industry outperformance is constant across business-cycle stages then differences in Jensen’s alphas should be statistically indistinguishable from zero. The null hypothesis is formally stated:

$$H_o : \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5$$

$$H_1 : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5$$

with α_j 's industry Jensen's alphas conditional on each of the five business-cycle stages as obtained from our model (eq.2). Based on the results of a Wald test of joint significance, we accept the null hypothesis of constant alpha returns for 35 industries at a 10% significance level. Generally there appears to be no pattern or clustering in any particular sector with the 18 industries that have significantly different alphas distributed across business-cycles.

Similar to our earlier analysis of alpha performance, Sharpe ratios provide a mixed picture at best of sector performance. Investors appear to be better off invested in the market index for every business-cycle stage except late expansion and early recession. The consumer staple and energy sectors provide the clearest Sharpe ratio outperformance over the entire business-cycle in late expansion. Otherwise there is no definite pattern of where sectors and industries provide the best outperformance using either Jensen's alphas or Sharpe ratios as a performance metric. Moreover, the results from our Wald test of joint significance indicate there is no difference in alpha returns for most industries across the stages of a business-cycle.

V. Sector Rotation Strategy

Next, we compare payoffs for a hypothetical dollar investment from December 1948 through December 2006 for three different strategies: market index, sector rotation, and market-timing. All strategies assume no short-sales. In Figure II we graphically illustrate the growth in value for each strategy over the 58 year period. We also report at the

bottom of Figure II terminal values and Sharpe ratios for each strategy and Jensen's alpha for the sector rotation strategy. Shaded areas on Figure II indicate NBER defined periods of recession.

[Please insert Figure II]

We first compare our sector rotation strategy to a simple investment in the market index. Our sector rotation strategy constructs portfolios by business-cycle stage with equal weighting for all industries included in that stage. For example, there are six industries in the Stage I (early expansion) portfolio held in weights of 1/6 each. Portfolios for each of the remaining four business-cycle stages are constructed likewise. Portfolios are rotated at each stage of the business-cycle. The market index strategy simply invests 100% in the market index continually from the start to the end of the sample period.

A sector rotation strategy outperforms the market index with terminal values of \$1,094 and \$372 respectively for the entire 1948-2006 period. Moreover, sector rotation has a Jensen's alpha of 2.1% for the full period that is significant at a 10% level. The overall risk/return trade-off measured by the Sharpe ratio is also marginally better for sector rotation (0.15) than for the market (0.13). However, the outperformance of sector rotation relative to the market index is uneven across the different business-cycle stages. Sector rotation underperforms the market index in both Stage I and Stage II with negative alphas of -5.3% and -1.0% respectively. Sharpe ratios for the market index are also

higher than those for sector rotation during both periods. Underperformance of the sector rotation strategy during Stage I and Stage II comes as no surprise given our earlier observation of the performance of sectors assigned to those two stages. Sector rotation provides the highest outperformance during Stage IV with a 10.3% Jensen's alpha and a Sharpe ratio that, while negative (-0.15), is vastly superior to the market Sharpe ratio (-0.43). However, the outperformance of sector rotation during Stage IV can be attributed to simply holding the two lowest beta sectors (utilities and communications) during a period when market returns turn highly negative.

Sector rotation shows much higher volatility than the market during periods of economic crisis as Figure II illustrates for the 1987 market crash, 1997/98 Asian economic crisis, and 2001 dot-com collapse. The amplified volatility seen in the sector rotation strategy illustrates the inherent additional risk of over-exposure to a limited number of sectors in comparison to the diversification benefits of holding the market index.

A profitable sector rotation strategy requires correctly timing the different stages of a business-cycle. The 2.1% outperformance of our sector rotation strategy comes from the benefit of an investor with 20/20 hindsight. However, business-cycles are notoriously difficult to forecast. More realistically, a real-time investor would be unable to correctly anticipate all business-cycle stages. The marginal outperformance we find for a sector rotation strategy is a best case scenario that would quickly dissipate without perfect hindsight and with an allowance for normal transaction fees. Our results suggest that,

although an investor with the ability to forecast business-cycles with 100% accuracy could marginally outperform the market, with more realistic assumptions it is unlikely that rotating sectors across business cycles yields superior returns.

As an alternative to sector rotation, we also consider a much simpler timing strategy. Market-timing is a strategy that invests fully in the market for all periods except the first period of a recession when only cash is held. Studies such as Siegel (1991) and Brocato and Steed (1998) among others document that investors should switch entirely from stocks to cash as the economy enters a recession. Our analysis similarly confirms that investors are better off completely out of equities during early recession. However, as with sector rotation, market-timing is dependent on correctly anticipating business-cycle conditions.

Results for the market-timing strategy are shown at the bottom of Figure II. The terminal value for market-timing is slightly higher than sector rotation at \$1,142 and \$1,094 respectively. Overall, market-timing (0.18) also outperforms sector rotation (0.15) from a Sharpe ratio perspective. The obvious advantages to market-timing over sector rotation is the need to forecast only one business-cycle stage rather five stages and a significant reduction in associated transaction fees. Additionally market-timing has better diversification than sector rotation. Even for an investor with the ability to correctly time business-cycles, a simple market-timing strategy would be optimal to sector rotation.

VI. Conclusion

We recognize certain limitations of our study. The partitioning of business-cycles into sub-periods of expansions and recessions is necessary to better observe sector/industry returns within broadly defined NBER economic phases. However, all business-cycles have somewhat different dynamics that our partitioning might fail to capture. Additionally, recessions that are relatively short in duration with a limited number of observations potentially influence our empirical results.

The results of our study show that a sector rotation strategy following conventional market wisdom on which sectors to rotate over the different stages of a business-cycle is not an optimal investment strategy. A sector rotation investor with the benefit of perfect hindsight timing business-cycles stages would have only realized a 2.1% Jensen's alpha from 1948-2006. This marginal outperformance would quickly dissipate without the benefit of 20/20 hindsight and after deducting transaction fees. Alternatively, we find that a much simpler market-timing strategy that shifts to cash early in a recession and holds the market index the remainder of a business-cycle outperforms sector rotation. We conclude that, contrary to conventional market wisdom, rotating sectors over business-cycles is not an optimal investment strategy and question the widespread acceptance of sector rotation as a strategy that provides investors with relative outperformance.

Table I

Notes: Panel A shows NBER reference dates for business cycle peaks and troughs from 1948 to December 2006. Business cycles are measured from the first month following a peak to subsequent peak. Periods of recession are counted as the first month following a cycle peak to the subsequent trough. Periods of economic expansion are counted as the first month following a cycle trough to subsequent peak. The last available NBER cycle date is the trough recorded March 2001. Estimates of early and middle stages of current expansion phase are based on available consensus forecasts.¹

Panel B shows total duration in months for recessions and expansions based on NBER turning points from Panel A. Further, similar to previous research we divide expansions into three equal stages (early, middle, and late) and recessions into two equal stages (early and late) to observe how sector returns align with market expectations.² The average duration of each stage is shown at bottom of Panel B.

Panel A: NBER business-cycle dates

Peak	Trough	Peak	Months
11/48	10/49	07/53	56
07/53	05/54	08/57	49
08/57	04/58	04/60	32
04/60	02/61	12/69	116
12/69	11/70	11/73	47
11/73	03/75	01/80	74
01/80	07/80	07/81	18
07/81	11/82	07/90	108
07/90	03/91	03/01	128
03/01	11/01	NA	NA

Panel B: NBER business-cycle phases divided by stage

Expansion				Recession		
Stage I	Stage II	Stage III	Total	Stage IV	Stage V	Total
Early	Middle	Late		Early	Late	
15	15	15	45	6	5	11
13	13	13	39	5	5	10
8	8	8	24	4	4	8
35	35	36	106	5	5	10
12	12	12	36	6	5	11
19	19	20	58	8	8	16
4	4	4	12	3	3	6
30	31	31	92	8	8	16
40	40	40	120	4	4	8
*30	*31	NA	NA	4	4	8
20	20	20	59	Avg: 5	5	10

¹ See Federal Reserve Bank of Philadelphia, 2007, The Survey of Professional Forecasters, *Federal Reserve Bank of Philadelphia Business Review* 1–13. <http://www.phil.frb.org/files/spf/survq207.html>

² See for example Stovall (1996), Sam Stovall's Sector Watch http://www.businessweek.com/investor/list/stovall_toc01.htm, and Fidelity Sector Funds at <http://personal.fidelity.com/products/funds/content/sector/basics.shtml.cvsr>

Table II

Notes: Table shows the stages of business cycle where previous studies and conventional market wisdom suggest sectors are expected to provide relative outperformance. Periods of expansion are divided into three equal stages (early, middle, and late) and are Periods of recession are divided into two equal stages (early and late). Industry portfolios are grouped by the first two digits of their SIC classification codes.¹ Each of the 48 industries portfolios in our study is assigned to a unique business cycle stage by their appropriate sector (shown in bold).

Three Stages of Expansion			Two Stages of Recession	
Stage I	Stage II	Stage III	Stage IV	Stage V
Technology: Computer Software Measuring & Control Equip. Computers Electronic Equipment	Basic Materials: Precious Metals Chemicals Steel Works Etc Non-Metallic & Metal Minin	Consumer Staples: Agriculture Beer & Liquor Candy & Soda Food Products Healthcare	Utilities: Gas & Electrical Utilities Telecom	Consumer Cyclical: Apparel Automobiles & Trucks Business Supplies Construction Construction Materials Consumer Goods Entertainment Printing & Publishing Recreation Restaraunts, Hotels, Motels Retail Rubber & Plastic Products Textiles Wholesale
Transportation: General Transportation Shipping Containers	Capital Goods: Fabricated Products Defense Machinery Ships & Railroad Equip. Aircraft Electrical Equipment	Medical Equipment Pharmaceutical Products Tobacco Products Energy: Coal Petroleum & Natural Gas		Financial: Banking Insurance Real Estate Trading
	Services: Business Services Personal Services			

¹ For a complete description of SIC codes included in each industry portfolio see http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_49_ind_port.html

Table III

Notes: Table reports descriptive statistics for value weighted industry returns, market returns, and Treasury-bill rates for full period and by business cycle stages. Periods of expansion are divided into three stages and recessions into two stages. Returns are shown in excess of the risk-free rate as annualized percentage points. Industry returns are ordered by the stage with expected outperformance then from lowest to highest market beta. Averages are shown by business cycle stage. We also report p-values from a Wald test of joint significance under the null hypothesis of equal returns across all cycle stages.

	obs	Full Period (697 obs.)			Expansion Stage I (206 obs.)			Expansion Stage II (208 obs.)			Expansion Stage III (179 obs.)			Recession Stage IV (53 obs.)			Recession Stage V (51 obs.)			Wald Prob.
		Mean	σ	β	Mean	σ	β	Mean	σ	β	Mean	σ	β	Mean	σ	β	Mean	σ	β	
Early Expansion:																				
Shipping Containers	697	7.3%	18.5%	0.98	13.3%	17.0%	0.96	11.2%	16.8%	0.97	-4.0%	20.0%	0.98	-12.6%	17.5%	0.96	34.8%	22.6%	1.08	0%
Transportation	697	6.0%	19.2%	1.07	19.7%	16.6%	1.00	8.1%	17.3%	1.07	-5.7%	19.9%	1.01	-30.5%	20.4%	1.09	37.4%	24.9%	1.24	0%
Measuring & Control	697	6.7%	23.9%	1.33	5.4%	21.7%	1.36	13.4%	21.0%	1.29	3.5%	25.5%	1.37	-29.3%	26.8%	1.26	47.9%	29.4%	1.37	0%
Computers	697	8.0%	23.9%	1.25	9.2%	22.5%	1.41	11.6%	20.0%	1.14	3.7%	26.7%	1.24	-24.2%	20.5%	1.03	48.7%	32.2%	1.41	0%
Electronic Equipment	697	6.8%	25.5%	1.44	12.3%	24.4%	1.51	10.4%	21.2%	1.30	0.2%	28.6%	1.59	-30.6%	26.1%	1.39	46.1%	29.2%	1.33	0%
Computer Software	498	-3.4%	42.2%	1.78	-4.3%	32.5%	1.69	6.1%	35.1%	1.35	-5.7%	46.7%	2.18	-54.8%	56.3%	2.37	50.9%	63.1%	1.41	13%
avg:		5.2%	25.5%	1.31	9.3%	22.5%	1.32	10.1%	21.9%	1.19	-1.3%	27.9%	1.39	-30.4%	27.9%	1.35	44.3%	33.6%	1.31	
Middle Expansion:																				
Precious Metals	522	2.5%	35.2%	0.68	1.0%	33.3%	0.41	3.0%	31.6%	0.74	3.0%	37.3%	0.50	-23.2%	39.1%	0.91	39.5%	47.0%	1.15	60%
Fabricated Products	522	-0.7%	24.2%	1.11	2.5%	23.3%	1.18	8.2%	20.0%	1.01	-1.6%	24.0%	0.97	-51.0%	31.2%	1.37	14.7%	32.3%	1.17	0%
Business Services	697	6.1%	18.7%	1.10	9.0%	17.2%	1.11	8.6%	15.9%	1.04	3.0%	19.9%	1.13	-28.5%	21.9%	1.13	44.0%	22.1%	1.08	0%
Defense	522	5.9%	23.5%	0.84	11.0%	20.6%	0.66	11.3%	20.7%	1.07	-5.0%	26.2%	0.69	-27.7%	25.0%	0.90	55.0%	29.8%	0.77	1%
Chemicals	697	6.0%	17.6%	1.01	15.3%	16.5%	1.07	7.7%	16.7%	1.12	-4.0%	17.8%	0.88	-15.6%	17.6%	0.95	25.6%	21.1%	1.07	0%
Aircraft	697	8.8%	23.1%	1.13	17.7%	20.2%	1.02	14.9%	20.8%	1.16	-3.1%	24.5%	1.10	-25.6%	27.0%	1.27	38.5%	29.0%	1.20	0%
Shipbuilding & Railroad	697	5.4%	21.6%	1.00	14.0%	21.2%	1.03	4.4%	18.9%	1.16	2.2%	21.5%	0.80	-27.4%	28.2%	1.22	30.2%	22.8%	0.87	1%
Personal Services	697	4.4%	22.9%	1.08	11.9%	16.6%	0.83	6.3%	21.7%	1.16	-3.1%	26.4%	1.17	-34.9%	28.3%	1.12	53.6%	23.3%	0.99	0%
Mining	697	6.0%	21.0%	1.00	12.4%	19.4%	0.93	8.2%	22.3%	1.20	5.0%	18.9%	0.85	-32.8%	23.5%	0.97	25.5%	22.4%	1.04	0%
Machinery	697	6.4%	19.2%	1.17	13.6%	17.0%	1.14	11.9%	17.9%	1.21	-0.3%	19.3%	1.11	-31.6%	20.8%	1.17	30.6%	25.1%	1.24	0%
Steel Works	697	4.3%	22.7%	1.25	12.0%	21.3%	1.34	9.4%	21.7%	1.25	-3.4%	24.1%	1.30	-30.3%	22.3%	1.10	26.7%	24.5%	1.14	0%
Electrical Equipment	697	9.0%	20.3%	1.19	13.1%	18.5%	1.20	14.7%	19.1%	1.27	4.5%	20.9%	1.17	-27.5%	21.0%	1.04	33.6%	24.5%	1.20	0%
avg:		5.3%	22.5%	1.05	11.1%	20.4%	0.99	9.1%	20.6%	1.12	-0.2%	23.4%	0.97	-29.7%	25.5%	1.10	34.8%	27.0%	1.08	
Late Expansion:																				
Tobacco Products	697	9.6%	20.2%	0.66	3.4%	22.2%	0.91	12.2%	18.4%	0.87	9.2%	21.4%	0.42	0.6%	15.5%	0.39	38.6%	18.2%	0.61	4%
Food Products	697	7.9%	14.4%	0.71	8.9%	13.5%	0.73	8.7%	12.9%	0.78	1.7%	15.6%	0.60	-6.3%	15.8%	0.76	42.8%	16.0%	0.70	0%
Petroleum & Natural	697	8.5%	17.4%	0.81	16.5%	15.1%	0.77	10.1%	17.1%	0.90	5.0%	16.8%	0.67	-24.4%	22.5%	1.02	24.9%	19.1%	0.78	0%
Candy & Soda	697	6.7%	21.7%	0.80	11.4%	21.0%	0.85	13.3%	18.0%	0.75	-2.6%	23.3%	0.67	-20.9%	23.2%	0.78	30.9%	27.6%	0.99	1%
Pharmaceutical	697	8.9%	17.4%	0.86	5.0%	17.4%	1.02	15.6%	16.5%	0.97	5.9%	16.6%	0.69	-10.9%	18.0%	0.83	33.7%	21.2%	0.85	1%
Beer & Liquor	697	7.7%	17.6%	0.82	8.5%	14.0%	0.73	11.3%	16.7%	0.90	3.0%	20.0%	0.79	-16.2%	16.1%	0.78	37.8%	23.2%	0.89	0%
Medical Equipment	697	8.8%	19.0%	0.92	6.9%	18.2%	1.02	9.4%	18.6%	0.97	6.4%	17.4%	0.82	-10.7%	21.2%	0.88	50.4%	23.5%	0.96	1%
Agriculture	697	3.7%	22.0%	0.93	4.6%	19.7%	0.93	10.1%	18.5%	0.86	1.5%	24.9%	0.93	-31.1%	27.3%	1.11	28.8%	23.2%	0.84	0%
Coal	697	7.6%	28.8%	1.07	13.7%	25.9%	1.11	2.6%	25.5%	1.10	15.3%	32.4%	0.99	-38.3%	28.0%	1.06	43.8%	34.4%	1.03	0%
Healthcare	522	0.9%	35.9%	1.25	8.9%	27.3%	1.11	-3.9%	33.9%	1.20	3.2%	41.0%	1.34	-51.5%	41.9%	1.18	73.9%	40.5%	1.18	1%
avg:		7.0%	21.4%	0.88	8.8%	19.4%	0.92	8.9%	19.6%	0.93	4.9%	22.9%	0.79	-21.0%	22.9%	0.88	40.6%	24.7%	0.88	
Early Contraction:																				
Communication	697	5.5%	14.7%	0.72	8.1%	15.7%	0.89	7.8%	11.8%	0.63	0.8%	16.2%	0.74	-9.6%	14.3%	0.65	20.3%	15.5%	0.60	3%
Utilities	697	6.2%	13.0%	0.54	9.4%	12.6%	0.67	7.4%	11.0%	0.51	0.1%	13.4%	0.33	-5.5%	16.4%	0.76	25.2%	15.3%	0.64	2%
avg:		5.9%	13.9%	0.63	8.7%	14.2%	0.78	7.6%	11.4%	0.57	0.4%	14.8%	0.54	-7.6%	15.3%	0.71	22.7%	15.4%	0.62	
Late Contraction:																				
Insurance	697	6.9%	18.4%	0.88	11.4%	17.1%	0.92	8.1%	15.6%	0.87	1.3%	20.1%	0.80	-18.4%	22.4%	1.05	37.6%	20.4%	0.86	0%
Rubber & Plastic	697	7.6%	19.7%	1.04	12.4%	17.2%	1.02	13.8%	18.5%	1.14	0.6%	21.3%	1.01	-26.7%	21.3%	1.01	33.8%	22.1%	0.89	0%
Consumer Goods	697	7.1%	16.2%	0.87	11.9%	14.5%	0.88	9.7%	15.2%	1.00	-2.1%	16.1%	0.70	-15.0%	17.6%	0.81	41.1%	20.8%	1.01	0%
Printing & Publishing	697	8.1%	19.5%	1.04	10.7%	17.8%	1.01	12.6%	16.8%	1.02	0.6%	20.0%	1.02	-24.7%	24.4%	1.16	54.4%	22.7%	1.02	0%
Automobiles & Truck	697	6.0%	20.3%	1.03	20.1%	19.1%	1.00	5.6%	18.8%	1.16	-4.1%	20.5%	1.00	-25.4%	19.8%	0.81	31.8%	24.6%	1.04	0%
Apparel	697	7.2%	21.2%	1.08	13.9%	18.2%	1.07	9.9%	18.9%	1.10	-2.0%	23.3%	1.07	-29.4%	20.3%	0.92	58.5%	27.0%	1.06	0%
Textiles	697	4.6%	20.1%	0.99	15.5%	18.8%	1.02	5.3%	17.7%	0.99	-5.8%	20.8%	0.91	-26.4%	21.1%	0.89	41.1%	24.6%	1.07	0%
Trading	697	8.9%	18.1%	1.11	15.6%	15.6%	1.09	13.2%	14.9%	1.01	0.5%	20.3%	1.16	-27.2%	21.5%	1.21	44.9%	21.4%	1.09	0%
Retail	697	7.0%	17.7%	0.99	10.9%	15.5%	0.95	4.7%	16.7%	1.03	3.0%	18.1%	0.97	-16.5%	18.3%	0.90	47.7%	23.5%	1.11	0%
Banking	697	8.8%	18.0%	0.95	11.7%	17.1%	1.02	9.6%	15.2%	0.90	3.1%	18.9%	0.90	-12.0%	20.5%	0.98	41.3%	23.1%	1.11	2%
Construction Material	697	6.9%	18.5%	1.10	13.0%	15.9%	1.05	11.2%	16.4%	1.13	-1.3%	20.0%	1.05	-28.0%	19.7%	1.09	43.9%	23.3%	1.16	0%
Wholesale	697	6.7%	18.7%	1.08	10.5%	15.3%	1.02	8.1%	17.9%	1.17	3.6%	20.3%	1.06	-24.4%	17.5%	0.94	38.2%	24.8%	1.17	0%
Real Estate	697	3.3%	23.4%	1.10	9.1%	20.9%	1.00	5.5%	19.6%	1.03	-0.4%	24.4%	1.02	-38.3%	28.3%	1.37	45.8%	30.4%	1.18	0%
Business Supplies	697	7.1%	19.2%	1.00	17.7%	17.7%	0.96	6.4%	17.9%	1.10	-1.1%	18.7%	0.83	-24.2%	20.6%	0.93	41.0%	24.5%	1.20	0%
Recreation	697	5.4%	24.8%	1.16	7.7%	23.0%	1.17	7.3%	23.5%	1.30	0.1%	25.4%	1.00	-26.4%	24.3%	1.10	55.6%	31.0%	1.21	0%
Entertainment	697	9.1%	23.9%	1.25	10.9%	21.7%	1.20	13.3%	20.7%	1.25	0.8%	25.9%	1.32	-12.2%	28.0%	1.43	44.1%	30.6%	1.25	8%
Restaurants & Hotels	697	8.5%	22.3%	1.10	12.4%	19.9%	1.08	12.0%	17.4%	1.00	4.3%	25.9%	1.12	-28.8%	24.4%	1.12	45.6%	28.2%	1.26	0%
Construction	697	6.0%	23.6%	1.26	6.7%	21.1%	1.19	8.2%	20.9%	1.20	8.5%	24.2%	1.23	-40.6%	23.7%	1.21	55.7%	32.5%	1.47	0%
avg:		7.0%	20.2%	1.06	12.3%	18.1%	1.04	9.1%	17.9%	1.08	0.5%	21.3%	1.01	-24.7%	21.9%	1.05	44.6%	25.3%	1.12	
Market		7.1%	14.5%	1.00	12.7%	12														

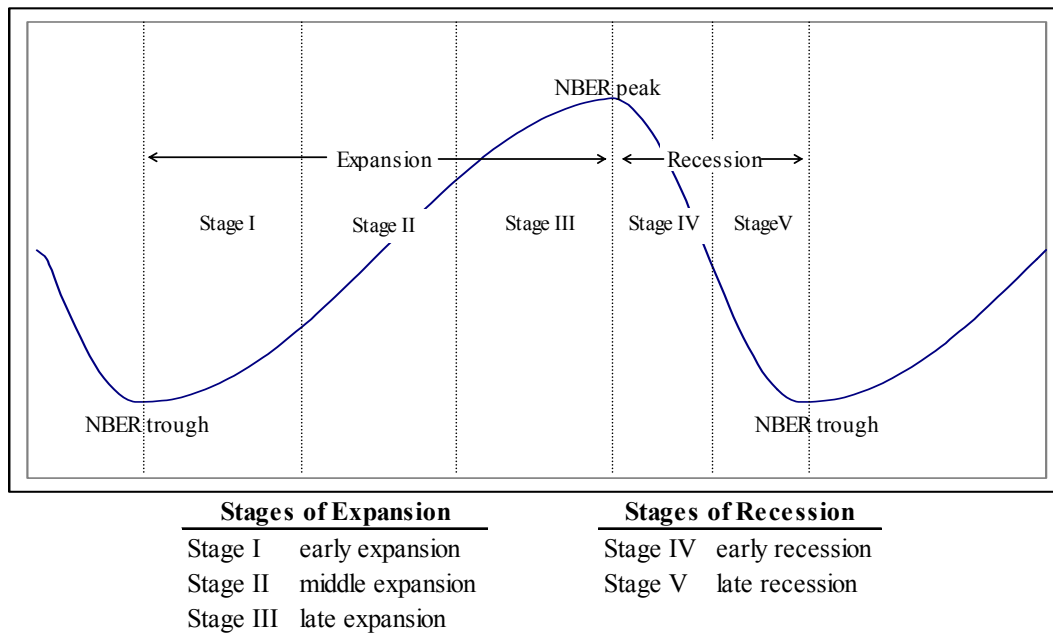
Table IV

Notes: Table reports Jensen’s alphas and Sharpe ratio performance measures for value weighted industry returns. Results are shown for the full period and also returns conditional on each of five business cycle stages. Jensen’s alphas are reported as annualized rates with t-stats based on White (1980) heteroskedasticity consistent standard errors. Sharpe ratios are calculated as excess industry returns divided by its standard deviation. Industry returns are ordered by the business cycle stage where they are expected to provide relative outperformance then from lowest to highest Sharpe ratio. We also report probability from a Wald test of joint significance under the null hypothesis of equal Jensen’s alphas by industry for all five business cycle stages.

	Full Period			Expansion									Recession			Wald Prob			
	Alpha	t-stat	Sharpe	Stage I			Stage II			Stage III			Stage IV				Stage V		
Early Expansion:																			
Computer Software	-10.6%	-2.25	-0.02	-15.7%	-2.26	-0.04	-5.3%	-0.67	0.05	-8.7%	-1.00	-0.04	5.0%	0.20	-0.39	7.5%	0.22	0.19	76%
Measuring & Control	-2.3%	-1.22	0.08	-10.1%	-3.42	0.07	1.2%	0.39	0.17	2.4%	0.61	0.04	-3.9%	-0.47	-0.37	-0.2%	-0.02	0.39	4%
Computers	-0.5%	-0.25	0.09	-7.3%	-2.25	0.11	1.0%	0.30	0.16	2.7%	0.54	0.04	-2.8%	-0.43	-0.39	-0.9%	-0.08	0.36	34%
Electronic Equipment	-2.9%	-1.48	0.07	-5.8%	-1.58	0.14	-1.5%	-0.50	0.14	-0.9%	-0.23	0.00	-2.6%	-0.38	-0.40	-0.4%	-0.04	0.38	89%
Shipping Containers	0.6%	0.40	0.11	1.4%	0.47	0.21	2.1%	0.74	0.18	-4.7%	-1.35	-0.06	10.0%	2.46	-0.22	-1.2%	-0.19	0.39	10%
Transportation	-1.2%	-0.83	0.09	6.7%	2.54	0.31	-1.6%	-0.61	0.13	-6.4%	-1.94	-0.08	-9.3%	-1.73	-0.51	-3.8%	-0.64	0.37	1%
avg:	-2.8%	0.07	0.07	-5.1%	0.14	0.14	-0.7%	0.14	0.14	-2.6%	-0.02	-0.02	-0.6%	-0.38	-0.38	0.2%	0.22	0.35	
Middle Expansion:																			
Precious Metals	-0.6%	-0.11	0.02	-2.2%	-0.22	0.01	-3.0%	-0.35	0.03	2.2%	0.21	0.02	5.2%	0.23	-0.19	5.6%	0.20	0.21	99%
Shipbuilding & Railroad	-1.3%	-0.57	0.07	1.2%	0.26	0.18	-5.8%	-2.00	0.07	1.6%	0.35	0.03	-2.4%	-0.22	-0.33	1.3%	0.11	0.34	58%
Personal Services	-2.7%	-1.24	0.06	1.7%	0.52	0.20	-4.1%	-1.17	0.08	-3.9%	-0.78	-0.03	-14.2%	-1.65	-0.43	15.9%	2.04	0.54	6%
Mining	-0.8%	-0.37	0.08	1.0%	0.27	0.18	-2.6%	-0.65	0.10	4.3%	1.17	0.07	-14.7%	-1.98	-0.49	-7.2%	-1.00	0.30	15%
Fabricated Products	-5.6%	-2.14	-0.01	-6.6%	-1.22	0.03	-0.3%	-0.08	0.11	-3.1%	-0.58	-0.02	-19.9%	-1.49	-0.64	-13.8%	-1.14	0.12	50%
Steel Works	-4.0%	-2.23	0.05	-4.2%	-1.35	0.15	-2.0%	-0.54	0.12	-4.3%	-1.20	-0.04	-8.9%	-1.42	-0.46	-9.0%	-1.06	0.28	86%
Chemicals	-0.8%	-0.66	0.10	1.9%	0.83	0.25	-2.5%	-1.23	0.13	-4.6%	-1.54	-0.07	6.1%	1.61	-0.28	-8.0%	-1.81	0.32	4%
Business Services	-1.3%	-1.02	0.09	-4.3%	-1.76	0.14	-0.9%	-0.47	0.15	2.2%	0.79	0.04	-5.9%	-1.03	-0.44	5.5%	1.01	0.48	25%
Defense	1.9%	0.64	0.07	5.5%	0.94	0.15	2.0%	0.48	0.15	-6.0%	-0.89	-0.06	-0.8%	-0.05	-0.37	29.0%	1.63	0.43	39%
Machinery	-1.5%	-1.19	0.09	-0.4%	-0.20	0.22	0.7%	0.29	0.18	-1.2%	-0.46	-0.01	-9.1%	-1.88	-0.53	-8.8%	-1.31	0.30	30%
Aircraft	1.0%	0.44	0.11	4.6%	1.24	0.24	3.9%	1.06	0.19	-3.9%	-0.84	-0.04	1.1%	0.12	-0.32	-2.0%	-0.14	0.33	66%
Electrical Equipment	0.8%	0.57	0.12	-1.6%	-0.69	0.19	2.7%	1.06	0.21	3.6%	1.21	0.06	-6.5%	-1.04	-0.44	-5.6%	-1.08	0.35	26%
avg:	-1.2%	0.07	0.07	-0.3%	0.16	0.16	-1.0%	0.13	0.13	-1.1%	0.00	0.00	-5.8%	-0.41	-0.41	0.2%	0.22	0.33	
Late Expansion:																			
Candy & Soda	1.3%	0.51	0.09	0.9%	0.20	0.15	6.0%	1.61	0.20	-3.1%	-0.57	-0.03	-4.5%	-0.45	-0.29	-1.7%	-0.11	0.28	64%
Agriculture	-2.4%	-1.03	0.05	-6.1%	-1.61	0.07	2.1%	0.58	0.15	0.8%	0.15	0.02	-9.6%	-0.97	-0.39	0.9%	0.09	0.32	49%
Healthcare	-4.6%	-1.03	0.01	0.0%	0.00	0.09	-12.9%	-1.77	-0.03	1.2%	0.12	0.02	-25.8%	-1.21	-0.48	31.5%	1.49	0.40	17%
Food Products	3.0%	2.17	0.15	0.0%	0.02	0.18	1.4%	0.74	0.19	1.2%	0.38	0.03	12.4%	2.01	-0.12	16.8%	2.72	0.66	5%
Beer & Liquor	2.1%	1.18	0.12	-0.3%	-0.14	0.17	2.8%	0.96	0.18	2.4%	0.56	0.04	1.1%	0.19	-0.32	6.7%	0.59	0.41	91%
Petroleum & Natural	2.9%	1.70	0.14	6.5%	2.33	0.29	1.7%	0.56	0.16	4.5%	1.25	0.08	-3.0%	-0.45	-0.36	-0.1%	-0.02	0.34	59%
Pharmaceutical	2.9%	1.79	0.14	-6.8%	-2.46	0.08	6.2%	2.27	0.25	5.4%	1.56	0.10	8.7%	1.39	-0.19	4.7%	0.64	0.40	1%
Medical Equipment	2.4%	1.33	0.13	-5.0%	-1.61	0.11	0.5%	0.14	0.14	5.8%	1.76	0.10	10.2%	1.22	-0.16	14.3%	1.63	0.51	5%
Tobacco Products	4.9%	2.01	0.13	-7.0%	-1.42	0.04	3.9%	1.14	0.18	8.8%	1.60	0.12	10.5%	1.41	0.01	16.4%	1.73	0.53	9%
Coal	0.3%	0.09	0.07	-0.1%	-0.01	0.14	-6.9%	-1.39	0.03	14.5%	1.81	0.13	-19.9%	-1.95	-0.49	7.2%	0.48	0.31	6%
avg:	1.3%	0.10	0.10	-1.8%	0.13	0.13	0.5%	0.15	0.15	4.2%	0.06	0.06	-2.0%	-0.28	-0.28	9.7%	0.48	0.42	
Early Contraction:																			
Communication	0.6%	0.46	0.11	-2.6%	-1.00	0.14	2.0%	0.93	0.18	0.2%	0.08	0.01	5.7%	1.29	-0.20	1.0%	0.16	0.35	51%
Utilities	2.5%	1.75	0.13	1.2%	0.48	0.21	2.8%	1.19	0.19	-0.2%	-0.06	0.00	13.3%	2.43	-0.10	4.0%	0.78	0.43	29%
avg:	1.6%	0.02	0.02	1.6%	0.02	0.02	1.6%	0.02	0.02	1.6%	0.02	0.02	1.6%	0.02	0.02	1.6%	0.02	0.02	
Late Contraction:																			
Automobiles & Truck	-0.9%	-0.52	0.08	7.0%	2.06	0.28	-4.7%	-1.71	0.08	-4.8%	-1.33	-0.06	-9.2%	-1.15	-0.43	-2.3%	-0.29	0.33	5%
Entertainment	0.5%	0.24	0.11	-3.5%	-0.89	0.14	1.6%	0.49	0.17	-0.2%	-0.04	0.01	23.4%	2.97	-0.13	0.6%	0.05	0.35	5%
Real Estate	-3.9%	-1.74	0.04	-2.9%	-0.75	0.12	-3.7%	-1.15	0.08	-1.1%	-0.23	0.00	-13.5%	-1.60	-0.49	4.1%	0.40	0.36	68%
Wholesale	-0.6%	-0.44	0.10	-1.8%	-0.91	0.19	-2.5%	-1.05	0.13	2.8%	0.83	0.05	-5.0%	-1.17	-0.46	-1.4%	-0.25	0.38	63%
Rubber & Plastic	0.5%	0.27	0.11	-0.2%	-0.06	0.20	2.9%	1.02	0.20	-0.2%	-0.05	0.01	-6.3%	-0.88	-0.42	3.4%	0.40	0.39	77%
Restaurants & Hotels	0.9%	0.43	0.11	-0.8%	-0.24	0.17	2.6%	0.90	0.19	3.4%	0.66	0.05	-6.3%	-0.89	-0.40	1.3%	0.14	0.39	76%
Construction	-2.4%	-1.23	0.07	-7.2%	-2.00	0.09	-2.6%	-0.76	0.11	7.5%	1.79	0.10	-19.8%	-2.76	-0.63	2.2%	0.20	0.40	1%
Textiles	-2.0%	-1.03	0.07	2.6%	0.71	0.22	-3.5%	-1.05	0.08	-6.4%	-1.63	-0.08	-8.5%	-1.24	-0.42	3.9%	0.48	0.41	34%
Business Supplies	0.3%	0.18	0.10	5.3%	1.57	0.27	-3.5%	-1.37	0.10	-1.7%	-0.49	-0.02	-5.0%	-0.67	-0.39	-0.2%	-0.03	0.42	31%
Recreation	-2.3%	-0.95	0.06	-6.1%	-1.46	0.09	-4.4%	-1.10	0.09	-0.7%	-0.13	0.00	-3.8%	-0.43	-0.36	10.2%	0.74	0.42	77%
Banking	2.2%	1.40	0.14	-0.8%	-0.29	0.19	1.3%	0.52	0.17	2.5%	0.71	0.05	11.3%	1.61	-0.18	2.6%	0.47	0.44	59%
Construction Material	-0.5%	-0.38	0.11	0.0%	0.02	0.22	0.7%	0.38	0.19	-2.0%	-0.63	-0.02	-6.2%	-1.26	-0.48	3.3%	0.60	0.46	64%
Insurance	0.9%	0.52	0.11	0.1%	0.05	0.18	0.2%	0.07	0.14	0.7%	0.16	0.02	5.2%	0.68	-0.26	7.5%	0.89	0.46	89%
Retail	0.2%	0.17	0.11	-0.7%	-0.32	0.19	-4.4%	-1.75	0.08	2.3%	0.81	0.05	3.7%	0.74	-0.29	7.4%	1.33	0.49	19%
Consumer Goods	1.2%	0.85	0.12	1.1%	0.43	0.23	0.5%	0.25	0.18	-2.6%	-0.85	-0.04	3.3%	0.55	-0.27	5.8%	0.79	0.49	77%
Apparel	-0.1%	-0.06	0.10	0.6%	0.22	0.21	-0.3%	-0.08	0.14	-2.8%	-0.63	-0.03	-11.5%	-1.72	-0.49	17.1%	1.68	0.50	18%
Trading	1.2%	1.09	0.14	1.9%	1.16	0.27	3.6%	1.98	0.24	-0.4%	-0.14	0.01	-2.2%	-0.55	-0.42	6.1%	1.21	0.51	51%
Printing & Publishing	1.0%	0.60	0.12	-1.6%	-0.50	0.17	3.0%	1.16	0.20	-0.1%	-0.04	0.01	-0.3%	-0.03	-0.33	15.4%	2.68	0.57	12%
avg:	-0.2%	0.10	0.10	-0.4%	0.19	0.19	-0.7%	0.14	0.14	-0.2%	0.01	0.01	-2.8%	-0.38	-0.38	4.8%	0.43	0.43	
Market	-	-	0.13	-	-	0.26	-	-	0.20	-	-	0.01	-	-	-0.43	-	-	0.46	

Figure I

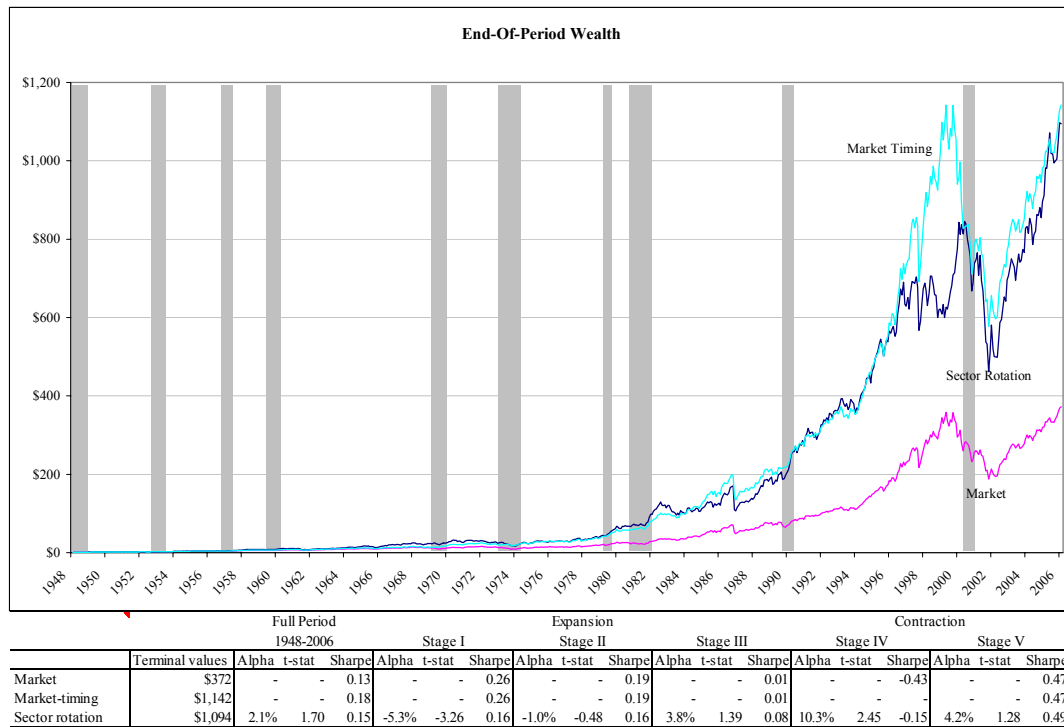
Notes: Figure illustrates a stylized economic business-cycle. The official government agency responsible for dating U.S. business cycles is the National Bureau of Economic Research (NBER). The NBER publishes dates for business-cycle peaks and troughs. Phases of expansion are measured from trough to peak and recession from peak to trough. As figure I illustrates, periods of expansion are typically much longer than periods of recession. Similar to previous research, we divide expansions into three equal stages (early/middle/late) and recessions into two stages (early/late) as shown.¹



¹ See for example Stovall (1996) and references by Fidelity Sector Funds at <http://personal.fidelity.com/products/funds/content/sector/basics.shtml.cvsr>

Figure II

Notes: Table reports end-of-period wealth from an initial investment of one dollar for each of the four investment strategies shown over the period 1948-2006. The market strategy simply holds the market portfolio for the entire period. Sector rotation strategy holds sector portfolios in equal weights during the business cycle stage in which they are expected to perform optimally. Market-timing holds the market portfolio for all business cycle stages except the early stage of a recession when cash is held. Jensen's alphas are obtained from a standard CAPM model. Jensen's alphas are reported as annualized rates with t-stats based on White heteroskedasticity consistent standard errors. Sharpe ratios are calculated as strategy returns in excess of the risk-free rate divided by its standard deviation. Shaded areas indicate NBER defined periods of recession.



References

- Avramov, Doron, and Tarun Chordia, 2006, Asset Pricing Models and Financial Market Anomalies, *Review of Economic Studies* 19, 1001-1040.
- Brocato, Joe, and Steve Steed, 1998, Optimal Asset Allocation Over the Business Cycle, *The Financial Review* 33, 129-148.
- Business Week Online, 2002, Get In, Get Out, and Move On, (McGraw-Hill Companies, Inc.).
- Chordia, Tarun, and Lakshmanan Shivakumar, 2002, Momentum, Business Cycle, and Time-varying Expected Returns., *Journal of Finance* 57, 985.
- Cover, James P., and Paul Pecorino, 2005, The length of US business expansions: When did the break in the data occur?, *Journal of Macroeconomics* 27, 452-471.
- DeStefano, Michael, 2004, Stock Returns and the Business Cycle., *Financial Review* 39, 527-547.
- Eleswarapu, Venkat R., and Ashish Tiwari, 1996, Business Cycles And Stock Market Returns: Evidence Using Industry-Based Portfolios., *Journal of Financial Research* 19, 121.
- Fama, Eugene F., 1975, Short-Term Interest Rates as Predictors of Inflation., *American Economic Review* 65, 269.
- Fama, Eugene F., and Kenneth R. French, 1989, Business conditions and expected returns on stocks and bonds, *Journal of Financial Economics* 25, 23-49.
- Federal Reserve Bank of Philadelphia, 2007, The Survey of Professional Forecasters, *Federal Reserve Bank of Philadelphia Business Review* 1-13.
- Fidelity Investments, 2007, Sector Education, (Fidelity Investments).
- Hong, Harrison, Walter Torous, and Rossen Valkanov, 2007, Do industries lead stock markets?, *Journal of Financial Economics* 83, 367-396.
- Hou, Kewei, 2007, Industry Information Diffusion and the Lead-Lag Effect in Stock Returns, *Review of Financial Studies*.
- Investment Company Institute, 2007. *Investment Company Fact Book* (Investment Company Institute).
- Menzly, Lior, and Oguzhan Ozbas, 2004, Cross-Industry Momentum, *Working Paper Series (SSRN)*.
- Philadelphia Federal Reserve Bank, 2007, Survey of Professional Forecasters, (Philadelphia Federal Reserve Bank).
- Sassetti, Paolo, and Massimiliano Tani, 2003, Dynamic Asset Allocation Using Systematic Sector Rotation, *Working Paper*.
- Siegel, Jeremy, 1991, Does it pay stock investors to forecast the business cycle, *Journal of Portfolio Management*.
- Stovall, Sam, 1996. *1995 Standard & Poor's Guide to Sector Investing* (McGraw-Hill).
- Tiwari, Ashish, and Anand Vihj, 2005, Sector Fund Performance: Analysis of Cash Flow Volatility and Returns, *Working Paper*.
- White, Halbert, 1980, A Heteroskedasticity-Consistent Covariance Matrix Estimator And A Direct Test For Heteroskedasticity, *Econometrica* 48, 817-838.