Which stocks are integrated?

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Abstract

We study the integration of individual US stocks with international equity markets in the period 1974 to 2015. We calculate yearly integration estimates for a firm by regressing its weekly stock returns on a set of principal components we construct using major non-US equity index returns. We find a positive and significant time trend in the average integration level over our sample period. We hypothesise that integration may vary across size and industry portfolios due to the economic fundamentals of firms and the impact of financial market trading. We find that integration levels are strongly positively related to firm size. Small stocks have low levels of integration throughout the sample period. We find positive and significant time trends in integration only for medium- and large-sized stocks. The increase in integration occurs across almost all of the 30 industries we examine. Financial, mining, oil, and steel stocks are particularly highly integrated in the later years of our sample. We also show that certain stocks are consistently ranked among the most integrated in the US market. Our findings have important implications for investors developing diversification strategies.

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1 Introduction

Equity market integration is an issue of central importance to asset pricing and risk management. International asset pricing models consider the influence of full or partial integration on portfolio choice and expected stock returns (Errunza and Losq, 1985; Stulz, 1981). The ability of investors to manage equity portfolio risk is also closely linked to financial integration. The motivation for equity investors to diversify by investing in several international markets is so as to avoid extreme negative performance in any one market. If the return dynamics of stocks across the world converge over time, then episodes of extreme negative performance may not be contained to just one market.

A key determinant of investor portfolio choice is thus the relationship between stock returns in different markets around the world. Measuring equity market integration is a key practical problem for investors in search of an optimal investment strategy. Unsurprisingly, a major strand of the empirical literature on equity market integration concentrates on estimating the level of financial integration between markets.

A common ex ante prediction in empirical studies is that equity market integration has increased in recent decades for developed countries such as the US. This prediction is informed by increased economic globalization in terms of increased trade in goods and services and cross-border capital flows. In addition, financial integration can in theory diverge from what we might expect given the real economic fundamentals of the assets in question. This financial market channel is most commonly portrayed as financial markets overreacting to isolated shocks and propagating international crises in "contagion" events. Such effects would naturally increase the level of comovement in asset returns across countries beyond levels consistent by economic fundamentals.

The extant literature mostly concentrates on studying the dynamics of national stock index returns across different countries. The principal question the literature asks is whether or not there is a significant trend in market integration over time. There is some controversy in the literature on this question. Some papers find little evidence of any significant time trend in integration. For instance, Bekaert et al. (2009) find no evidence of an increase in integration for US stocks in the period 1980 to 2005. On the other hand, Pukthuanthong and Roll (2009) find a positive time trend in the integration level of the S&P500 with global equity markets. Christoffersen et al. (2014) similarly find a significant increase in US equity market integration. Other historical studies, such as

Rangvid et al. (2016), also find substantial increases in developed market integration in recent decades.

An issue we know much less about is how the level of integration varies across stocks within a given market. A typical strategy in equity market integration studies is to consider the relationship between major national index returns. This approach gives a basic summary of how market integration has developed by using the index as a proxy for the market. However, national equity indices are generally some form of value-weighted index of only the largest stocks in a given market. It is quite possible that this approach masks substantial cross-sectional variation in integration across stocks.

Studying how financial integration varies with individual firm characteristics can potentially provide us with a number of useful empirical facts. We can better understand how equity market integration has evolved over time and try to link this path to real economic and financial channels. Also, this analysis has major practical implications for investors implementing international diversification strategies. If financial integration differs predictably for different categories of stocks, then a richer knowledge of these dynamics offers investors an avenue to conduct their portfolio risk management more effectively.

In this paper, we study the financial integration of individual US stocks with global equity markets in the period 1974 to 2015. We calculate adjusted-R^2 integration estimates using Pukthuanthong and Roll (2009)-style regressions. We regress weekly individual firm returns on principal components we construct using major international equity index returns. The adjusted-R^2 from these regressions provide a measure of how much of the variation in individual US stock returns is sensitive to the same factors that explain the variation in the national stock indices of other major developed countries.

We first consider a principal question in the equity market integration literature by investigating whether average US stock integration has a significant time trend. We find that both equal- and value-weighted average integration series have increased significantly in the period 1974 to 2015.

We next consider the how integration varies across size and industry portfolios. Why might financial integration vary across these portfolios? First, large firms may have stronger real economic ties with other world economies relative to smaller firms. For

example, larger firms may sell more products in overseas markets compared to smaller firms. Thus, a greater portion of larger firms' returns may be explained by global factors. Also, investors who purchase foreign stocks generally hold large well-known stocks (Ferreira and Matos, 2008; Kang and Stulz, 1997). This provides a channel through which investors can influence returns in their own domestic market and in a segment of foreign equity markets as a response to a potentially common shock. Thus, larger firms may be more integrated with world equity markets relative to smaller firms.

Second, the industrial classification of a firm may influence its stock's integration level. For instance, firms in an industry which produces predominantly non-tradable goods or services may have returns which depend less on global factors than the returns of export-led firms. Also, firms in industries which have historically been highly regulated – such as utilities – may be less integrated relative to firms in other industries. We explore differences in integration across 30 industry portfolios by drawing on four-digit Standard Industrial Classification (SIC) codes from CRSP.

We find a very large size effect in our results. Quintile and decile portfolio sorts reveal a strongly positive relationship between firm integration and firm size. Large firms are significantly more integrated than small firms. The gap in integration between small and large firms has increased over time. This is also reflected in the fact that we find no evidence of significant time trend for small firms. Medium-sized to large firms have seen strongly significant increases over our sample period.

Our industry analysis reveals strong evidence of a significant increase in integration between 1974 and 2015 for almost of our 30 industry portfolios. These increases are strongest for industries such as Automobiles, Coal, Financial Services, Mining, Oil, and Transportation. We find weaker evidence of a positive time trend for our Consumer Goods, Healthcare, and Tobacco industry portfolios.

We also investigate a number of stocks for which we estimate persistently high levels of integration. Financial, Mining, and Oil stocks dominate this set of highly integrated stocks from the early 1990s until the end of our sample period in 2015. We observe very high levels of integration in these years for companies such as copper-producer Freeport McMoRan and financial institutions Citigroup and Morgan Stanley.

In summary, the financial integration of individual US stocks varies substantially across size and industry portfolios. Small firms are significantly less integrated than medium-to-large firms. This offers an avenue for investors seeking to refine their international diversification strategies. We also find that the significant increase in average integration levels is not confined to a small number of industries. However, we do find that financial, mining, and oil stocks record some of the highest levels of integration in our sample.

The remainder of this paper proceeds as follows. Section 2 provides a review of the literature on financial market integration. Section 3 discusses our methodology. Section 4 gives the details of our data. Section 5 presents our results and provides a discussion of how they relate to the extant literature. Section 6 concludes.

2 Literature Review

What do we know about the development of equity market integration through time? This is a key line of inquiry in the literature. The comparison of national equity index returns is the foundation of many of the main contributions to the literature.

A number of studies have examined long-run trends in equity market integration by analyzing how national index return correlations have changed over time. Longin and Solnik (1995) find that equity index return correlations increased from 1960 to 1990 in a sample of seven major developed countries. Goetzmann et al. (2005) examine a longer time period of 1850 to 2000 and find considerable time variation in return correlations. They report that levels of correlation in the late 1990s were high by historical standards, but comparable to levels seen between 1900 and 1939.

High levels of return correlation in the early and late 20th century tally with the view of Obstfeld and Taylor (2003) that capital market integration developed in a U-shaped pattern over the course of the century. Quinn and Voth (2008) report similar results from an 1890-2005 sample. They find that levels of return correlation were relatively high in the early 20th century, low during both World Wars, and increased to historic highs in the period 1990 to 2005. Rangvid et al. (2016) use a simple model-free measure of integration and similarly find that capital market integration followed a U-shaped path over the course of the 20th century.

Christoffersen et al. (2014) study international equity market integration using a variety of models including the dynamic conditional correlation (DCC) model of Engle (2002). They find evidence of increasing correlations in the period 1973 to 2012 for both developed and emerging market countries.

Pukthuanthong and Roll (2009) demonstrate that correlation-based measures of financial integration can be misleading; returns driven by sensitivities to the same factors can have low levels of correlation. They propose another measure. They argue that an integrated stock market should have asset returns which are sensitive to common global equity factors. They first construct principal components using the returns of a basket of international equity indices. They then regress index returns for a particular country on these principal components in each year of their sample. The adjusted-R^2 of this regression is their measure of integration. Higher adjusted-R^2 values imply higher levels of stock market integration.

The main result of Pukthuanthong and Roll (2009) is that equity market integration increased significantly in the period 1973 to 2008 for many developed and emerging market countries. The increase is stronger for developed market countries and European countries in particular. A relevant finding for our study is that the US market – as proxied by the S&P500 – also experienced a significant increase in integration over this period.

Bekaert et al. (2011) propose another methodology to quantify integration levels. They measure market segmentation using differences in industry earnings yields across countries. They argue that large differentials are indicative of market segmentation as competition for investments in an integrated market would push earnings yeilds closer together. They find that the segmentation of developed markets declined steadily from 1980 to 2000 and remained relatively low until 2008. Segmentation is higher in emerging market countries and a there is much weaker evidence of a sustained decrease is segmentation for these countries.

Carrieri et al. (2007) study equity market integration for eight emerging market countries from Central America, South America, and Asia. They use a GARCH-in-mean approach with the Errunza and Losq (1985) international asset pricing model to measure time-varying integration. They find increasing levels of integration in the period 1977 to 2000. However, they also note that their integration measures are not monotonically

increasing over time as they include occasional reversals following increases.

It is important to note that not all studies find evidence of increasing global equity market integration. Bekaert et al. (2009) study equity market integration among a set of 23 developed countries between 1980 and 2005. They investigate a number of return correlation measures including some implied by factor models. They find that only European markets experienced increased levels of integration in this period.

Why might we expect that equity market integration has changed over time? Are the dynamics of integration determined by economic fundamentals, investor sentiment, or institutional trading activity? Economic fundamentals may contribute to explaining the level of similarity in equity returns in different markets. It may be that fundamentals such as cross-border trade and exposure to the common economic risks have become relatively more important for firms over time.

Still, the impact of increased economic integration among countries on financial integration is theoretically ambiguous. As Bekaert et al. (2009) note, the impact of globalization on cross-country return correlations could be negative. Increased cross-border trade may promote industrial specialization in each country and thus reduce return correlations. However, Baele and Inghelbrecht (2009) find evidence that increased trade openness is accompanied by increased equity return correlations. This is particularly evident in Europe between 1973 and 2007.

Institutional changes can also impact equity market integration. Bekaert and Harvey (2000) find that stock market liberalizations lead to increases in return correlations and betas of emerging market returns with world equity returns. Quinn and Voth (2008, 2010) study the impact of relaxing capital control regulations. They also find that increased financial openness is associated with increased return correlations.

Investor sentiment offers another channel through which equity market integration may increase over time. If investors have systematically biased expectations about future stock returns, then their trading behavior has the potential to shift expected returns away from levels consistent with firm fundamentals (Baker and Wurgler, 2007). The role of arbitrageurs in classical financial theory is to correct any such mispricing. However, a large literature on the limits of arbitrage documents reasons why arbitrageurs may not play this role (Gromb and Vayanos, 2010). Thus, unchecked investor sentiment could

impact domestic stock returns. Importantly, investor sentiment could also influence the level of international return comovement. This could happen if investors trade in different markets or if sentiment is shared by investors in different markets.

Financial market contagion is a closely related idea which fits naturally into a limited arbitrage theoretical framework. Contagion events are often described as occurring at times of extreme swings in investor sentiment or market panic (Karolyi, 2003). If investors overreact to a negative economic shock and arbitrageurs do not intervene, then prices of various assets could fall by an amount unjustified by their exposures to the shock. Thus, an increase in the amount of cross-border financial trading or a convergence in sentiment across markets could contribute to an increase in return comovement over time.

Another strand of literature investigates the impact of institutional investor behavior on international return comovement. The key hypothesis in this literature is that the relationship between returns in different markets may be influenced by shifts in demand from large investors which are unrelated to the assets' economic fundamentals. Jotikasthira et al. (2012) show that investor behavior in developed market funds can lead fund managers to make trades which have a large and economically significant impact on emerging market returns. Bartram et al. (2015) also demonstrate that the impact of institutional investors on international stock returns is of comparable magnitude to traditional country and industry factors. Antón and Polk (2014) and Greenwood and Thesmar (2011) provide similar contributions relating institutional demand to return comovement in the context of the domestic US equity market.

How does equity market integration vary across industries and categories of stocks? This question has received relatively less attention than cross-country studies using national index returns. Bekaert et al. (2009) investigate differences in integration levels across some firm characteristics. They argue that the style of a portfolio - such as small versus large and growth versus value - is the "main organizing principle in the US asset management industry." They show that large growth stocks are more correlated across countries than small value stocks. In another study, Bekaert et al. (2011) note that previously heavily regulated industries such as banking and insurance had low levels of integration in the 1970s and very high levels of integration in the early 21st century.

Eun et al. (2008) provide an interesting study of international diversification potential along a size dimension. They construct small-, mid-, and large-cap equity funds using data from a sample of 10 developed countries and study the correlation dynamics of the funds. They find that the small-cap funds have low correlations with large-cap funds and with other small-cap funds. Thus, they argue that small foreign firms may offer a particularly strong international diversification benefit.

Bartram and Wang (2015) use a copula-based measure to study equity market integration in Europe at an industry level. They find that most industries see an increase in dependence following the introduction of the Euro. The largest impact occurred for Industrials, Consumer Goods, Technology and Telecommunications, and Utilities. For comparison, the authors calculate an adjusted-R^2 measure of integration following Pukthuanthong and Roll (2009). They find that this measure provides very similar results on the development of integration over time.

Berben and Jansen (2005) study cross-country return correlations of market and sector indices in the Germany, Japan, the UK, and the US from 1980 to 2000. They find evidence of large increases in correlations for most country pairs. Japan is an exception as its index returns show little evidence of increased correlation with the other countries. At a sector level, we see quite a lot of diversity in which industries show significant increases in correlation. Basic industries, cyclical services, and non-cyclical consumer goods show the strongest evidence of increased correlations. However, none of the six country pairs show a significant increase in correlation for the utilities sector.

Brooks and Del Negro (2006) study return comovement at a firm-level using data from 20 countries. The key finding of their paper is that companies with high levels of overseas sales have higher levels of international return comovement. However, it should be noted that data availability issues restrict their analysis to a relatively modest sample size of 1,239 stocks.

Eun et al. (2014) study the integration of portfolios of US states organized by state with the US market as a whole. Their measure of integration is the Pukthuanthong and Roll (2009) adjusted-R^2 measure. They use corporate headquarters as a measure of geographic location. They find some evidence of increasing integration of state and regional portfolios to the overall US market.

3 Data

We collect our data in two steps. First, we source daily price series and firm characteristics for individual US stocks from CRSP. We study only common stocks of firms which are incorporated in the US and listed on the NYSE, NASDAQ, or NYSE MKT (formerly AMEX) exchanges. We include only common stocks incorporated in the US

Second, we gather daily equity index series for a set of 10 major developed countries from Thomson Reuters Datastream. These countries are Australia, Canada, France, Germany, Hong Kong, Italy, Japan, Singapore, Switzerland, and the UK. Table 1 provides the details of these index series. We choose to work with total return indices over price indices where possible as the former include dividend payments. We convert all foreign-denominated indices to US dollars.

We choose our set of ten countries with regard to each country's economic development and the cumulative contribution of the countries to world equity market capitalisation. We collect data from the World Bank on the size of national equity markets. We find that the cumulative market capitalisation of our set of 10 countries plus the US represents an average of 86.3% of world equity market capitalisation in the period 1975 to 2014. The US is almost always the largest block with an average share of 44.1% of global market capitalisation. The market capitalisations of our 10 non-US countries sum to 42.2% on average. Stated differently, our ten non-US countries make up an average of 75.5% of non-US world equity market capitalisation.

Our sample period runs from 1974 to 2015. We choose our sample start date with reference to the availability of index data from Datastream. A small number of country indices are available from the mid-1960s, but data for a wider set of countries are available from 1973 onwards. One point to note is that, similarly to Pukthuanthong and Roll (2009), we construct PCA-based integration estimates which are out-of-sample by one year. That is, the weights we apply in the construction of our principal components are based on data which is lagged by one year. Thus, the first year for which we have firm integration estimates is 1974 rather than 1973.

We choose to work with returns at a weekly frequency. This decision is guided by the need to strike a balance between conflicting objectives. First, we require a satisfactory number of returns in each period to calculate PCA-based integration estimates. This

suggests the need for reasonably high-frequency returns. Second, we wish to minimise the influence of microstructure issues commonly observed in higher-frequency returns of individual stocks. We believe that weekly returns provide a good compromise in our setting.

An important point to note is that public holidays are not uniform across the 11 countries in our sample. This results in days in which only a subset of our assets record non-zero returns. In addition, we observe some evidence of sluggish trading among our individual US stocks whereby prices can go unchanged even if the US market is open. Given that our core objective is to study the how returns in different markets relate to one another, arbitrary trading restrictions such as public holidays may distort our results. Thus, we are careful to ensure that the return calculation for a given week refers to the same set of trading days for the individual stock and the set of international equity indices.

We calculate daily returns for each individual US stock and our set of equity indices. We then use these daily returns to construct weekly returns. Our default construction method is to calculate a weekly return using the five trading days of Thursday to Wednesday. We require the individual stock we are analysing and all of the international indices to record a non-zero return on both days. If this condition is breached, then we switch to one of the following trading week definitions in order: Thursday-to-Thursday, Thursday-to-Tuesday, Wednesday-to-Wednesday, Wednesday-to-Tuesday, Wednesday-to-Thursday, Tuesday-to-Tuesday, Tuesday-to-Wednesday, or Tuesday-to-Thursday. If insufficient data are available to construct a valid weekly return in this way, then we record the return as missing.

4 Methodology

We calculate adjusted-R^2 integration estimates for each stock in our sample using Pukthuanthong and Roll (2009)-style regressions. We regress weekly individual stock returns on a set of out-of-sample principal components which we construct using national stock index returns from 10 other major developed markets. Our principal components are out-of-sample in the sense that the eigenvector weights which we apply to our index returns are calculated using index return data from the previous year.

We choose to work with five principal components in our integration regressions. This choice is guided by the data. Five eigenvectors are typically enough to explain 90% or more of the variation in our set of equity index returns. This 90% threshold is our decision-making criterion in all cases. Appendix A provides further details on this issue.

Each firm must have a minimum of 30 valid weekly returns in any given year if we are to calculate an integration estimate for the firm in that year. This restriction ensures that our regression results are not determined by a very small number of weekly return observations.

Our measure of firm size is end-of-year market capitalization. This estimate allows us to perform portfolio sorts on size. In each year, we sort all stocks with a valid integration estimate by firm size. We assign each stock into a portfolio. We use both quintile and decile portfolio splits as a robustness check. We also use end-of-year market capitalization to determine value-weights for our overall cross-section analysis and also our industry portfolio sorting analysis.

We test for a statistically significant time trend in our various integration series by regressing the series in question on a time trend of 1974 to 2015. We take the t-statistic of the time-trend coefficient from these regressions as our indication of statistical significance.

5 Results

In this section, we present the results of our stock-level integration analysis. We organise these results as follows. First, we examine the broad trends in the data over time and in the cross-section of stocks. Second, we study the variation in average integration across size portfolios. Third, we consider differences in average integration across industry portfolios. Fourth, we explicitly test for time trends in our various integration series. Fifth, we identify particular stocks which consistently show high levels of integration over time. Lastly, we discuss our results and place them in the context of the literature.

5.1 Integration over time and in the cross-section

We find two basic facts in our results. First, equal- and value-weighted average integration levels appear to have risen over time. This trend is more pronounced for the value-weighted average. Second, our integration estimates vary considerably across stocks.

Table 2 presents summary statistics for our individual stock integration estimates in each of the 42 years of our sample period. EW-Avg. and VW-Avg. are the equal- and value-weighted average integration series, respectively. These averages vary considerably through time. Prior to 2002, the EW-Avg. series is 10% or below in each year bar 1987. The series rises in the later years of the sample period and is particularly high (18-25%) between the years 2008 and 2011. The measure falls towards its historical average in the final four years of the sample. The VW-Avg. displays similar time series dynamics, but rises quite strongly after the year 2000. The series is consistently high in the years 2008 to 2012 with a range of 25.65% to 42.47%.

Our results indicate that larger stocks are more integrated than smaller stocks. The VW-Avg. series is higher than the EW-Avg. series in every year except 1977, 1978, and 1985. The difference between the two series is quite small prior to the 1990s, but is quite large in recent years. The difference is approximately 18% in the years 2002 and 2011. We explore the relationship between integration levels and firm size more fully in Section 5.2.

Our integration estimates for the year 1987 are outliers relative to the years immediately before and after. The EW-Avg. series records a sample high of 33.31% in this year. The VW-Avg. estimate of 37.78% for this year is exceeded only in 2010. The principal driver of this result is likely the October 1987 stock market crash.

The median integration series is similar that for the EW-Avg. The median is typically 1 to 3% lower than the EW-Avg. figure, but otherwise displays very similar time series dynamics. Prior to 2002, the median breaches 10% only once. Again, the estimate for 1987 is a striking outlier. The series moves from 1% in 1986 to 34.78% in 1987 and falls to 5.56% in 1988. The years of 2007 to 2012 also see relatively high median levels of integration which range from 11.4% to 24.81%. These figures provide us with some confidence that our average results are not wholly driven by outliers.

An important feature of our results is that there is a substantial amount of cross-

sectional variation in integration levels in our sample of stocks. The standard deviation of our integration measures in a given year demonstrates this large spread. The magnitude of the standard deviation is larger than that of the EW-Avg. in most years of the sample. The figures range mostly from 9 to 12%. The highest values of 18 to 19% are for 1987, 2010, and 2011. Our previous results suggest an important role for size in understanding cross-sectional differences in integration levels. We later examine a number of other firm characteristics.

The minimum and maximum integration values in a given year also provide an indication of the differences in integration across firms. The lowest measure in each year is typically -17 to -19%. Negative adjusted-R^2 estimates show that the stock in question has an unadjusted estimate close to zero and that our penalty for additional principal components is pushing the integration estimate further below zero. The maximum values range from 44.78% to 83.21%. Prior to the year 2000, the highest integration values are generally between 50 and 60%. After the year 2000, the maximum values mostly range from 60 to 80%. The increase in the maximum value in the final 15 years of the sample suggests that stocks with the highest integration estimates are reaching levels which are high by historical standards. We again see that 1987 is an outlier with the highest integration estimate of the entire sample period of 83.21%.

Figure 1 illustrates the average integration time series over the 1974 to 2015 sample period. The differences between the equal- and value-weighted averages is clear over time. Thus, larger firms appear to have high integration levels. The spike in integration in 1987 is very clear. In particular, the equal-weighted average registers its sample high in this year. Both average series trend upwards from the year 2000 until approximately 2011. The series fall in the last years of the sample to levels seen in the early-to-mid 2000s.

Figure 2 presents boxplots for each year in the sample period showing the distribution of integration measures across stocks. The inter-quartile range is bounded above by 20% for 34 of the 42 years of the sample. The distribution jumps up in 1987 and the inter-quartile range runs from approximately 20 to 50%. We also see an upward shift of the distribution in the years 2008 to 2011.

We observe outliers throughout the sample period. These are stocks which register high integration estimates relative to the median in a given year. We don't observe a strong upward time trend in the values of these outliers, but we do see some evidence

of higher outliers between 2000 and 2012. The absence of negative outliers reflects the relatively low median values throughout the sample period.

5.2 Integration across size portfolios

We next investigate the relationship between our stock-level integration estimates and firm size. We hypothesise that larger firms may be more integrated with global equity markets through both a real economic channel and a financial market channel. First, larger firms may have higher sensitivities to shocks in overseas markets through exports or foreign direct investment. In addition, larger firms may be more reliant on imports for their production processes and so be relatively sensitive to global economic risk factors.

Second, investors who purchase stocks in foreign countries typically hold large and well-known stocks (Ferreira and Matos, 2008; Kang and Stulz, 1997). Thus, the trading activity of domestic investors could increase return co-movement with foreign stock markets and large foreign stocks in particular. For example, domestic investors may face a common negative economic shock and so choose to sell stocks so as to boost their present consumption or to reduce their risk exposure. This provides a channel through which domestic investors increase return co-movement through their trading decisions.

Our analysis of stock-level integration and firm size is based on the study of size-based stock portfolios. In each year, we sort our sample of US stocks from smallest to largest. We then organise these stocks into quintile portfolios and calculate average integration levels for each portfolio in each year of our sample. We measure firm size using the end-of-year market capitalization for each stock.

Figure 3 plots average integration series for size-sorted quintile portfolios in each year from 1974 to 2015. Portfolio 1 contains the smallest 20% of stocks in each given year and portfolio 5 contains the largest 20% of stocks. We see substantial differentials in the average integration estimates for the five portfolios in Figure 3. This is especially clear in the years after 1990. The larger portfolios appear to have higher levels of average integration.

Table 3 reports the adjusted-R^2 figures underlying Figure 3. The average difference between the largest portfolio and the smallest portfolio is 10.37% over the course of our sample period. The difference is positive for 41 of the 42 years. The exception is 1977

when all five portfolios have low integration estimates ranging from 0.43% to 2.08%. The difference is most pronounced in the second half of the sample period. The figure is particularly high from 2001 until 2015. The largest differences are in the years 2009, 2010, and 2011. The 2010 estimate for portfolio 5 is 37.08% while the corresponding estimate for portfolio 1 is just 4.34%.

We also observe evidence of average portfolio integration levels increasing monotonically with firm size. This pattern holds in 33 of the 42 years of the sample and in each year from 1994 to 2015. For example, our estimates for 2015 are, in turn, 3.71%, 6.73%, 10.61%, 14.93%, and 21.05%. In the years in which this monotonic pattern doesn't hold, we see that the magnitudes of the average integration differences are quite small. For example, the highest portfolio integration estimate of 4.99% in 1975 is for portfolio 3. The larger portfolios 4 and 5 have slightly lower estimates of 4.76%, and 4.09%, respectively. In summary, our results demonstrate a strong positive relationship between stock-level integration and firm size.

Our quintile portfolio results also allow us to consider time trends in integration for size-sorted portfolios. Informal examination of the data show little evidence of a time trend for the smallest 20% of stocks (portfolio 1). Our estimates for this portfolio are relatively high in 2008, 2009, and 2011. However, our later estimates for 2012 to 2015 range from 0.8% to 3.71% and are comparable in magnitude to levels seen in the earliest period of our sample.

The average integration estimates for Portfolio 2 suggest that there may be a modest positive time trend. Still, this may be driven mostly by the years of 2008 to 2011 where the portfolio average ranges from 13.81% to 16.47%. We observe stronger evidence of a positive time trend for portfolios 3, 4, and 5. Average integration levels for these three portfolios increased quite strongly after the year 2000. This increase in most evident for portfolio 5 - the largest 20% of stocks. The highest estimate of all portfolios in any year is 40.88% for portfolio 5 in 2011. The average portfolio integration estimates fall after 2011, but our portfolio 5 estimates remain high by historical standards.

Our estimates for 1987 are outliers for all five portfolios. The estimate of 23.09% for portfolio 1 is comfortably the highest estimate for this portfolio for the entire sample period. Similarly, 1987 is also the sample high for portfolios 2, 3, and 4. The 39.05% estimate for portfolio 5 is only slightly lower than the 40.88% estimate in 2011. This

1987 spike in our average integration measures is clearly not restricted to just one section of small or large stocks.

We repeat this analysis using decile portfolios as a robustness check and report our results in Figure 4 and Table 4. Our findings remain the same. Integration is strongly positively related to firm size. In fact, average portfolio integration rises almost monotonically with size. We also find that extreme deciles do not have substantially higher or lower average integration estimates compared to neighbouring deciles. Portfolios 1 and 2 have similar average integration estimates and the same is true of Portfolios 9 and 10. This strongly suggests that our average size portfolio results are not being driven by only the smallest or largest stocks in our sample.

Our results throughout this size portfolio analysis tally with our equal- and value-weighted average results in Figure 1. It is clear that larger stocks are more integrated than smaller stocks. This empirical finding is strongest in the years between 2000 and 2015. On the other hand, the smallest stocks show little evidence of any sustained increase in integration over time. The increases we see in equal- and value-weighted average integration levels from 1974 to 2015 appear to be driven by the largest 60% of stocks and especially by the largest 20% of stocks.

5.3 Integration across industry portfolios

We next examine how integration varies across different industries. In each year, we organise our stocks into one of 30 industry portfolios using four-digit firm SIC codes in the manner suggested by Ken French. Table 5 provides details on each of these thirty industries.

Figure 5 shows equal-weighted average adjusted-R^2 integration time series for each of our 30 industry portfolios. For clarity, we split our results into six panels each containing five industries. These plots illustrate some basic features of our results. First, all industries have low equal-weighted average integration in the early years of our sample. All series lie mostly between 0 and 15% from 1974 to 2000. This tallies with Figure 1 in which we showed that average integration across the full cross-section of stocks was low and flat prior to the year 2000. Second, 1987 is again a major outlier and this is true for all industries. We see estimates of approximately 30 to 40% for most industries in this

year.

Third, our results suggest that integration increased for the majority of industries in the period 2000 to 2015. The magnitude of these increases varies across industries. In some cases, the increase occurs after 2005. For example, the increase we observe for electrical equipment is mostly confined to 2005 to 2012. In other cases, the integration series rise markedly from around 2001. These industries include chemicals, coal, mines, oil, and utilities. Notably, the financial industry integration series is quite low relative to other major industries throughout the sample period.

Fourth, we see evidence of a significant decline in integration in the final years of our sample period. This drop is mostly seen in 2012 and 2013. By 2015, our average industry integration series mostly remain above their historical averages, but well below their historical highs.

Table 6 reports these equal-weighted adjusted-R^2 integration estimates for each of our 30 industries in each year of our sample. These figures confirm the low levels of average integration across all industries in the early years of our sample. The highest estimates in this period are in 1987 and they range from 19.24% for utilities to 47.2% for chemicals. These figures are clearly outliers relative to estimates in neighbouring years.

Coal has some of the highest equal-weighted integration estimates in the post-2000 period. Our estimates for 2002 and 2004 are 33.87% and 33.28%, respectively. Indeed, the highest yearly estimate we find for any industry is 54.01% for coal in the year 2009. Other estimates for coal in the 2007-2011 period are all above 40%. Mines, oil, and steel also have estimates ranging from 30 to 45% in this period.

Food and Healthcare are among the least integrated industries. Our estimates for the food industry range from 1.56% to 7.58% between 2000 and 2006, 12.41% to 21.97% from 2007 and 2011, and 4.4% to 10.24% from 2012 to 2015. We see similarly low estimates for the healthcare industry. Integration estimates for this industry rise to between 11.62% and 18.86% from 2007 to 2011, but revert to a low level outside this period.

Figure 6 presents equivalent results where we value-weight our average integration estimates within each industry portfolio. These plots show that value-weighted industry portfolios have low levels of integration at the start of our sample. In 1974, most

industries record estimates of 0 to 15%. Estimates for early years in the sample are relatively low. We again find that the year 1987 is a prominent outlier. However, these value-weighted averages show much more evidence of an upward trend in the 1974 to 2000 period compared with our equal-weighted average series. Many industries record values consistently between 15 and 30% in this period.

Again, our results show a substantial increase in integration for the majority of industries in the post-2000 period. This is most pronounced for industries such as coal, mining, oil, financials, and steel. These industries record values of between 30 and 60% over this period.

Table 7 provides the value-weighted adjusted-R^2 estimates for each of these 30 industries. The highest estimates are mostly contained in the post-2000 period. For the oil industry, we see estimates consistently between 30 and 60% from 2005 to 2012. Similar patterns exist for coal, fabricated products, financials, mining, and steel. The 2009 estimate for the coal industry is the highest in our sample period at 62.22%. Food and healthcare are again among the least integrated industries.

Value-weighting within industries clearly boosts the integration estimates relative to equal-weighted averages. This is particularly evident from 2007 to 2011 when these value-weighted series range from 20 to 40%. This again highlights the impact of firm size on integration we examined in Section 5.2.

In summary, our integration results for these industry portfolios suggest that there may be a positive trend over time for almost almost all 30 industries we examine. In particular, it appears that the coal, financial, mining, oil, and steel industries have all recorded large increases in integration since 2000.

5.4 Integration time trend tests

We next conduct time trend tests on our integration series. Our results thus far suggest that integration may be trending upwards for many of our stocks. We test this by running yearly regressions of our various adjusted-R^2 series on time. Our test is to determine whether the time trend t-statistic is significantly different from zero. We naturally include a constant in these regressions so as not to upwardly bias our trend estimates.

Table 8 presents our results. Panel A gives time trend t-statistics from regressions of equal- and value-weighted average integration series on time. The equal-weighted average has a time-trend t-statistic of 2.804 which is significant at a 1% significance level. The value-weighted average time trend t-statistic is higher at 4.856 which is also significant at a 1% significance level.We further consider the impact of our 1987 integration estimates on these time trend results. We expect the unusually high integration estimates for this year may reduce our time trend t-statistics by a non-trivial margin. Thus, we exclude this year from our time trend analysis and consider how this impact on our results. We find that the equal-weighted average t-statistic increases to 4.176 and the value-weighted average t-statistic increases to 5.851. Excluding the 1987 integration estimates increases both time trend t-statistics and the change is larger for the equal-weighted average statistic. This is consistent with our earlier finding that the 1987 outlier appears to more pronounced for the equal-weighted average series.

Figure 5 previously suggested the existence of positive time trends for the portfolios containing medium-to-large stocks. The five portfolio series begin at a level of approximately 0% to 10%. The estimates for the largest portfolios rise to 20% to 40% in the final 15 years of the sample period. We see little evidence of any time trend for the smallest stocks as portfolio 1 remains below 10% for the majority of the sample.

Panel B of Table 8 provides the results of time-trend t-tests using our size-based quintile portfolio series. We observe strongly significant positive time trends for portfolios 4 and 5. These two portfolio average integration series have time-trend t-statistics of 3.53 and 4.544, respectively. Both are significant at a 1% significance level. Portfolio 3 has a positive time-trend t-statistic of 2.437 which implies significance at a 5% level. The smallest two portfolios (1 and 2) have significant time trends. Portfolio 1 has a time-trend t-statistic of -0.016. Portfolio 2 has a corresponding t-statistic of 1.176 which is positive, but insignificant at conventional significance levels.

Another finding is that the difference in the average integration levels of the largest portfolio 5 and the smallest portfolio 1 has a strongly positive time trend. The time-trend t-statistic for this difference is 6.915 and is significant at a 1% level. This result follows directly from what we find above. Larger stocks have become more integrated, while smaller stocks have not.

We again consider the impact of the 1987 outliers on our time-trend analysis. We remove our integration observations for this year and repeat our time-trend regressions. This boosts the time-trend t-statistics for all five quintile portfolios. The time-trend test statistics for portfolios 4 and 5 remain positive and strongly significant. The statistic for portfolio 3 increases to 3.704 and so is significant at a 1% level. The result for portfolio 2 rises to 2.343 and is significant at a 5%. We again find no evidence of a significant time trend for the portfolio 1 average. The portfolio's time-trend t-statistic rises to 0.713, but cannot reject the null hypothesis of no time trend.

Panel C provides a similar analysis for our size-sorted decile portfolios. Our results are similar to what we find for quintile portfolios and our main conclusions are unchanged. We find that the decile portfolios containing the largest stocks show evidence of strong positive time trends. Decile portfolios 6 through 10 in Panel C show strong evidence of a positive time trend from 1974 to 2015. The time-trend t-statistics for these portfolios range from 2.831 to 4.614. All are significant at a 1% level. Decile portfolio 5 has a t-statistic of 2.024 and is significant at a 5% level. We see no significant time trends for decile portfolios 1 through 4. Decile portfolio 4 comes closest to significance with a positive t-stat of 1.56.

Removing the outlying estimates for the year 1987 impacts on our results in a similar fashion to our quintile analysis. The time trends for decile portfolios 1 and 2 remain insignificant with t-statistics of 0.45 and 0.907, respectively. However, the time trend t-statistics for deciles 3 and 4 become significant at a 10% and 1%, respectively. The equivalent t-statistics for portfolios 5 through 10 all rise and are significant at a 1% level.

Lastly, we consider time trends in equal- and value-weighted average integration among 4-digit SIC-based industry portfolios. Panel D shows time trend t-statistics for each of our 30 portfolios using equal-weighted average integration series. The vast majority of industries have display positive and significant time trends. Coal (5.90), steel (4.916), and oil (4.383) have among the most significant trends. However, trends for health (0.802), food (1.453), and smoke (1.136) are positive but insignificant at conventional significance levels. Excluding 1987 boosts the significance of all 30 trend statistics, but the trend statistic for smoke remains insignificant at 1.66.

Panel E reports equivalent trend statistics using value-weighted average industry integration series. We get stronger results for most industries by using these value weights.

Household goods and retail are the two exceptions to this rule, but still both retain positive and significant time trends. Our time trend for financial stocks is stronger at 5.442 versus 2.285 in Panel D. This suggests that larger financial firms are driving the increase in this industry. Similarly, industries like mines, autos, fabricated products, steel, chemicals, and telecommunications display more significant trends compared with our equal-weighted results.

5.5 Most integrated firms

Our results thus far show that a small number of stocks have very high levels of integration in any given year. Figure 2 illustrates this empirical regularity. In this section, we investigate which firms these are.

In each year, we rank firms from highest to lowest based on a 5-year moving average of yearly adjusted-R^2 integration measures. The moving average for stock i in year t is a simple average of the adjusted-R^2 for stock i from year $t-4$ to year t. This process truncates our sample by four years. Thus, our first integration ranking refers to the year 1978. We choose to calculate moving averages so as to reduce the impact of outliers in individual stock adjusted-R^2 series on our rankings. We provide a discussion of this issue and year-by-year rankings in Appendix B.

Table 9 presents the results of our ranking of the most integrated stocks.

Financial firms have the most integrated stocks from 1997 to 2007. Morgan Stanley (previously Morgan Stanley Dean Witter) is ranked third in 1997 and 1998 with adjusted-R^2 values of 28.61% and 34.01%, respectively. This firm also has the most integrated stock for the four years of 2000 to 2003 with 5-year moving averages ranging from 32.65% to 48.58%. We also note that Dean Witter Reynolds - which merged with Morgan Stanley in 1997 - is among the highest ranked firms in 1978 and 1980.

Travelers Group is the third most integrated stock in 1995, the second most integrated stock in 1996, and the most integrated stock in 1997. The integration estimate moving averages for the firm ranges from 26.17% to 31.33%. In 1998, Travelers Group merged with Citicorp to form Citigroup. This new entity has the most integrated stock in 1998 and the second most integrated stock in 1999. The stock appears again in our

ranking in each year from 2002 to 2005.

Affiliated Managers Group – an asset management firm – has the most integrated stock in our sample from 2004 to 2007. The stock is also ranked second in 2002 and 2003. The firm adjusted-R^2 moving average ranges from 41.15% to 49.49% over these six years. The stock appears again in our ranking in 2013 with an adjusted-R^2 of 57.47%. Other financial stocks which rank highly include Summit Bancorp, Lehman Brothers, and JPMorgan Chase.

Mining firms make up a large proportion of the most integrated stocks between 2006 and 2015. Copper producer Freeport-McMoRan has the most integrated stock in our sample in the years 2008, 2009, 2010, and 2013. The stock is also ranked second in 2007. The adjusted-R^2 values for these years range from 40.6% to 62.84%.

Apache Corporation – an oil and gas exploration and production firm – has the most integrated stock in the years 2011 and 2012. The adjusted-R^2 values for these two years are 61.82% and 64.88%, respectively. Denbury Resources – another oil and gas exploration firm – is the third most integrated stock in 2011 and the second most integrated stock in 2012. Whiting Petroleum – yet another oil exploration and production company – features in our rankings from 2008 to 2011. The stock's moving average integration values range from 44.27% to 61.22% over these years.

Du Pont has the most integrated stock in the three years from 1994 to 1996. The stock is also ranked second in 1997. The moving average for the stock in these years ranges from 28.42% to 31.15%. The stock of Norfolk Southern Corporation is the most integrated in our sample for the years 1990 to 1993. The stock also ranks second in 1988. The stock's moving average values in these years range from 26.67% in 1993 to 44.75% in 1991.

Our rankings in the early years of our sample provide a less clear picture than those for later years. The most integrated firms from 1978 to 1990 represent many different industries including communications, financials, mining, and utilities. The firms E-System, Contel Corporation, and Helen of Troy Corporation all feature as the most integrated stock in two successive years in this period.

5.6 Discussion

We next provide a discussion of our results and how they relate to the literature on equity market integration. Our findings contribute the literature on the evolution of US equity market integration over time. We find that the average integration level of US stocks has increased in recent decades. Our average integration series have positive and statistically significant time trends in the period 1974 to 2015. This result contrasts with the finding of Bekaert et al. (2009) that US stocks experienced no significant increase in integration between 1980 and 2005. The report significant increases in equity market integration for European countries only. Using another measure, Bekaert et al. (2011) find that equity market segmentation fell for developed markets from the early 1980s until the late 1990s. Their measure is relatively flat – and even increases mildly – from 1997 to 2006. In contrast, we observe the largest sustained increase in our average US integration measures from the late 1990s until the end of our sample period in 2015.

Our individual stock-based finding of a positive time trend in US equity market integration is consistent with a number of recent papers which study the relationships between national index returns across countries. For instance, Pukthuanthong and Roll (2009) find a significant positive time trend in the integration level of the S&P 500 index with other developed country national indices. Christoffersen et al. (2014) also find increasing average dynamic correlation estimates between their US index and other developed and emerging market indices in the period 1995 to 2012. Similarly, Rangvid et al. (2016) report a large increase in equity market integration for Germany, France, Spain, the UK, and US from 1975 to 2012.

Our results demonstrate the importance of firm size. This is apparent in a number of ways. Our value-weighted average integration estimates are consistently higher than our equal-weighted estimates. Portfolio sorts reveal a strong relationship between firm size and integration. Large firms are more integrated than small firms. The difference has grown between 2000 and 2015. This result is also reflected in that the fact that while the integration of medium-to-large stocks has increased significantly in recent decades, the integration of small stocks shows no significant time trend. Our results on size match with the findings of Eun et al. (2008) who show that larger firms have higher correlations with foreign stocks than smaller stocks. Bekaert et al. (2009) also found that large growth stocks are more integrated than small value stocks.

An important point to note is that national equity indices are generally some form of value-weighted average of the largest stocks in a given market. If only large stocks become more integrated with global equity markets, then studies examining national equity indices may come to misleading judgements about integration trends for the broader equity market. It may be the case that only a subset of stocks are becoming more integrated. Our findings suggest that researchers studying equity market integration should be cognisant of the limitations of using equity indices to infer the level of equity market integration for the stock market as a whole.

The increase in US equity market integration we document has important implications for investors. International diversification strategies using developed country equity markets are likely to be less effective in recent years compared with the pre-2000 period. Our evidence shows that an increased proportion of the variance of individual US stock returns is captured by common global equity factors. The value-weighted average of this proportion was 24.05% for US stocks in the post-2000 period. These trends demonstrate that US stocks have become more integrated with world equity markets and that foreign stock markets offer less beneficial diversification benefits for US investors.

We also observe episodes of very high levels of integration. For instance, our value-weighted average integration series records values of 33.45%, 38.55%, and 42.47% in the years 2009, 2010, and 2011. We also see a large jump in this measure to 37.78% in 1987. Though these episodes are most severe for larger stocks, we also observe increases in integration for smaller stocks in these years.

Our integration analysis also reveals that each year there are a set of firms with exceptionally high levels of integration. In some cases, firms register an unusually high estimate for just one year of the sample. However, we observe that some firms have extended periods of high integration. These firms are almost exclusively large firms and are very often components of well-known indices such as the S&P 500 and the Dow Jones Industrial Average.

We see relatively high amounts of diversity in the industrial classification of the most integrated stocks in the first half of the sample period. However, financial, mining, and oil stocks make up the vast majority of this set from 1997 until the end of our sample period in 2015. This analysis suggests that particular firms are exceptionally highly integrated relative to the average stock and even relative to other stocks in the same industry. For

example, Travelers Group, Citigroup, Morgan Stanley, and Affiliated Managers Group all record very high levels of integration relative to other financial stocks in the period 1997 to 2007.

This finding raises an issue for an investor seeking a portfolio which is diversified both industrially and geographically. Selecting large firms to represent an industry – such as Freeport McMoRan for mining or Citigroup for financials – may result in substantial underdiversification.

The moral for investors seeking diversification is that smaller stocks are likely to bring greater benefits than larger stocks. This is especially the case when we compare smaller stocks with very large and well-known stocks.

6 Conclusion

The average US firm has become significantly more integrated in the period 1974 to 2015. Our equal-weighted average adjusted-R^2 integration measure is approximately 5 to 10% in the period 1974 and 2000 and 10 to 25% in the 2000 to 2015 period. Our value-weighted average is quite similar to the equal-weighted average from 1974 to 1990. After this point, the value-weighted average starts to rise markedly. We see an especially sharp rise in the post-2000 period.

We sort firms into quintile and decile size portfolios and confirm that there is a strong positive relationship between integration and firm size. Moreover, the increase in average integration is driven by medium- to large-sized stocks. Small stock portfolios have low levels of integration throughout our sample period and show no signs of significant time trend.

The rise in integration is experienced across almost all of the 30 industry portfolios we construct. It is quite clear that the positive and significant time trend is not confined to just a few industries. Some industries, such as food and healthcare, show only weak evidence of a positive time trend. However, most industries show positive and strongly statistically significant time trends. A set of industries show particularly large increases in integration over time. These include the coal, financial, mining, oil, and steel industries.

We also find that some firms are especially highly integrated. In recent years, this set of firms has included copper producer Freeport-McMoRan, the oil and gas firm Apache, and the financial firms Citigroup and Morgan Stanley.

Our results demonstrate the increasing difficult investors face in diversifying portfolio risk as US stocks have become increasingly integrated with other world equity markets. That said, our findings also show that small US stocks remain largely segmented from other world markets. This provides investors with an important tool for implementing diversification strategies. We also find that some industries are more integrated than others. This also provides another way in which investors can better diversify risk, though it should be noted that almost all of the 30 industries we examine experience positive and significant increases in integration from 1974 to 2015.

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Table 1: Equity Index Data

Country	% Mkt. Cap.	Index Name	Index Mnemonic
Australia	1.81	Total Market Index	TOTMAU$
Canada	5.15	Total Market Index	TTOCOMP
France	3.11	Total Market Index	TOTMKFR
Germany	3.41	Dax 30 Index	DAXINDX
Hong Kong	2.19	Hang Seng Index	HNGKNGI
Italy	1.68	Total Market Index	TOTMIT$
Japan	15.25	Nikkei 225 Index	TOKYOSE
Singapore	0.70	Total Market Index	TOTXTSG
Switzerland	2.07	Total Market Index	TOTMKSW
UK	7.46	Total Market Index	TOTMUK$
US	44.08	-	-

This table provides the details of the equity indices we use in our study. % Mkt. Cap. refers to the average size of each country's equity market as a percentage of the world equity market in the period 1975 to 2014 based on World Bank data. Index Name provides the name of the time series. Total Market Index refers to the Datastream-created market index for a given country. Index Mnemonic shows the Datastream query mnemoic for a given series. In addition, we source each series by enclosing its index mnemonic in a decimal place function of the form DPL#(•,6) which gives series up to six decimal places. This change allows us to avoid some minor calculation errors caused by the Datastream currency conversion tool.

Table 2: Integration summary statistics

Year	EW-Avg.	VW-Avg.	Median	Std.Dev.	Min.	Max.
1974	10.41	12.75	9.32	12.34	−17.63	59.01
1975	4.27	4.66	2.64	10.88	−17.14	62.26
1976	8.31	9.09	7.26	11.61	−18.91	57.93
1977	1.31	1.31	−0.13	9.39	−19.25	49.03
1978	3.20	2.87	2.16	9.59	−18.68	43.21
1979	4.17	4.53	2.69	10.67	−18.82	46.73
1980	9.48	12.73	8.70	11.25	−18.62	55.13
1981	5.29	6.37	3.72	10.80	−17.63	53.57
1982	8.95	11.35	7.96	11.92	−19.33	55.22
1983	2.27	4.66	0.65	9.87	−19.91	54.01
1984	5.47	8.90	3.82	11.73	−18.85	50.90
1985	1.04	0.78	−0.57	9.74	−18.66	53.55
1986	2.36	5.33	0.99	9.65	−18.87	56.17
1987	33.31	37.78	34.78	19.19	−15.88	83.21
1988	7.23	14.56	5.56	12.96	−18.24	69.77
1989	2.71	6.01	1.06	10.84	−19.65	49.31
1990	9.72	19.11	8.35	14.22	−18.40	64.22
1991	8.55	16.19	7.29	12.50	−19.50	56.13
1992	0.29	2.62	−1.45	9.29	−18.28	50.76
1993	0.42	1.15	−1.07	9.05	−19.14	52.18
1994	4.45	11.80	2.83	11.35	−17.84	62.26
1995	1.74	3.74	0.08	10.01	−19.44	59.72
1996	3.76	12.38	1.98	10.83	−19.58	52.63
1997	4.31	12.52	2.60	10.66	−17.74	55.10
1998	7.48	13.44	6.09	11.75	−18.52	60.20
1999	2.68	9.93	1.23	9.49	−17.40	44.78
2000	5.07	9.24	3.26	10.80	−18.30	61.14
2001	9.01	20.43	6.22	14.01	−17.79	68.10
2002	13.33	31.48	10.46	15.54	−19.32	74.06
2003	9.75	23.07	7.73	12.73	−15.20	62.21
2004	9.09	12.21	7.43	11.47	−17.70	58.48
2005	5.31	8.70	3.65	9.79	−15.52	50.54
2006	9.12	15.44	6.53	13.07	−17.35	66.48
2007	12.67	23.55	11.40	12.78	−15.11	59.76
2008	18.78	28.50	16.78	16.42	−16.07	81.09
2009	20.69	33.45	18.81	17.65	−14.09	75.80
2010	21.49	38.55	19.94	18.29	−14.36	75.77
2011	25.49	42.47	24.81	18.96	−13.58	77.48
2012	14.26	25.65	11.70	15.41	−16.53	74.83
2013	5.63	10.62	3.94	10.11	−16.58	54.20
2014	11.44	24.00	8.68	13.87	−18.07	66.97
2015	11.40	22.67	9.01	13.46	−17.02	61.79

This table provides summary statistics for our integration series in each year from 1974 to 2015. EW-Avg. and VW-Avg. refer to the equal-weighted and value-weighted average adjusted-R^2, respectively. Median gives the median adjusted-R^2 in the sample of stocks in a given year. Std.Dev. gives the standard deviation, Min. gives the lowest integration estimate, and Max. gives the highest integration estimate in the cross-section of stocks in the given year.

Table 3: Integration by size quintile portfolios

	Portfolios					
Year	1	2	3	4	5	5-1
1974	8.15	9.04	10.25	11.30	13.32	5.17
1975	2.58	4.93	4.99	4.76	4.09	1.51
1976	6.24	7.77	9.35	9.29	8.92	2.69
1977	1.79	2.08	1.33	0.43	0.91	−0.88
1978	1.47	3.43	3.92	3.21	3.99	2.53
1979	2.62	3.47	4.33	4.64	5.79	3.17
1980	6.80	8.70	9.11	9.88	12.90	6.10
1981	3.66	4.78	5.61	5.71	6.68	3.03
1982	4.53	7.87	10.39	10.58	11.42	6.88
1983	2.07	1.89	1.97	2.63	2.79	0.72
1984	3.76	4.38	4.49	5.95	8.74	4.98
1985	0.75	0.69	0.71	1.41	1.64	0.89
1986	0.52	1.38	2.74	3.14	4.00	3.47
1987	23.09	30.96	35.16	38.27	39.05	15.95
1988	3.34	3.89	6.72	8.93	13.30	9.96
1989	0.37	1.03	3.36	3.04	5.75	5.38
1990	3.31	7.00	8.81	11.76	17.74	14.44
1991	2.82	5.63	8.45	10.71	15.12	12.30
1992	−0.32	−0.55	−0.08	0.34	2.04	2.36
1993	0.54	−0.07	0.35	0.34	0.96	0.43
1994	0.71	2.83	3.32	5.33	10.07	9.35
1995	−0.03	0.04	1.56	2.54	4.60	4.63
1996	0.59	1.86	2.51	4.01	9.82	9.24
1997	1.08	2.47	3.79	4.76	9.45	8.37
1998	2.62	4.76	7.66	9.38	12.99	10.36
1999	0.53	0.80	2.13	3.28	6.68	6.15
2000	3.69	3.70	5.17	5.62	7.20	3.51
2001	3.42	4.85	6.93	12.28	17.56	14.14
2002	4.45	6.40	10.51	17.05	28.25	23.80
2003	2.17	3.54	8.99	14.11	19.95	17.78
2004	2.20	5.64	9.50	13.60	14.51	12.31
2005	1.07	2.78	5.05	8.45	9.21	8.14
2006	2.10	4.50	8.57	13.48	16.94	14.84
2007	5.56	8.23	12.42	16.01	21.15	15.59
2008	10.74	13.96	18.83	21.34	29.05	18.31
2009	8.24	13.81	20.44	27.20	33.77	25.53
2010	4.34	14.85	22.60	28.62	37.08	32.75
2011	8.61	16.47	26.90	34.63	40.88	32.27
2012	3.07	9.96	16.07	18.48	23.72	20.66
2013	0.80	3.63	6.14	8.06	9.52	8.72
2014	3.67	5.99	8.67	14.66	24.23	20.56
2015	3.71	6.73	10.61	14.93	21.05	17.34

This table provides average integration estimates for each of five size-sorted quintile portfolios. In each year, we organise stocks into quintile portfolios based on end-of-year firm market capitalization. We then calculate average integration for each portfolio using our adjusted-R^2 integration measures for each stock. The portfolios are ordered from smallest to largest. The final column (5-1) gives the difference in average integration between portfolio 5 (largest) and portfolio 1 (smallest).

Table 4: Integration by size decile portfolios

	Portfolios										
Year	1	2	3	4	5	6	7	8	9	10	10-1
1974	7.96	8.34	7.67	10.41	10.83	9.70	10.44	12.12	12.73	13.96	6.00
1975	1.74	3.49	4.40	5.39	5.11	4.86	5.09	4.43	3.66	4.53	2.78
1976	6.10	6.44	7.04	8.42	8.98	9.77	9.42	9.16	8.38	9.47	3.37
1977	1.98	1.60	2.52	1.65	1.21	1.44	0.76	0.11	0.55	1.27	−0.72
1978	0.56	2.37	3.57	3.29	3.83	4.01	3.22	3.19	4.19	3.81	3.24
1979	2.25	2.99	3.26	3.79	3.43	4.99	4.80	4.67	5.50	6.04	3.80
1980	6.69	6.91	8.12	9.29	9.31	8.94	9.92	9.86	12.04	13.73	7.04
1981	2.89	4.44	4.38	5.19	4.97	6.18	5.70	5.76	6.67	6.69	3.81
1982	4.05	5.08	7.02	8.67	9.55	11.22	10.13	11.03	11.96	10.87	6.83
1983	1.96	2.18	2.30	1.48	2.16	1.79	2.58	2.69	2.20	3.38	1.42
1984	3.98	3.51	4.13	4.72	4.16	4.69	5.78	6.24	8.09	9.37	5.40
1985	0.27	1.30	0.66	0.66	1.16	0.25	0.82	2.01	1.78	1.50	1.23
1986	0.28	0.78	1.15	1.61	3.02	2.47	2.67	3.61	3.24	4.75	4.47
1987	20.06	26.16	29.65	32.27	35.29	35.08	37.69	38.82	39.20	38.89	18.84
1988	2.25	4.44	3.27	4.50	5.69	7.75	7.87	9.99	11.97	14.64	12.39
1989	0.72	0.00	1.13	0.96	2.88	3.84	3.65	2.44	5.39	6.12	5.40
1990	2.95	3.67	6.32	7.70	8.33	9.27	10.60	12.93	15.65	19.84	16.89
1991	2.35	3.33	5.62	5.70	7.68	9.13	9.72	11.70	14.52	15.77	13.42
1992	0.05	−0.69	−0.85	−0.25	−0.58	0.41	0.79	−0.09	0.91	3.18	3.13
1993	0.15	0.93	−0.83	0.66	0.20	0.49	0.20	0.50	1.06	0.87	0.72
1994	−0.05	1.48	2.08	3.58	2.80	3.85	4.70	5.97	8.33	11.81	11.86
1995	−0.22	0.16	−0.11	0.20	1.49	1.61	2.30	2.78	3.86	5.34	5.56
1996	0.67	0.52	1.89	1.82	2.44	2.58	2.91	5.12	7.27	12.38	11.71
1997	1.09	1.07	2.08	2.85	3.41	4.16	4.59	4.93	7.88	11.02	9.93
1998	2.00	3.27	4.17	5.35	7.48	7.84	9.14	9.61	11.99	13.98	11.98
1999	0.59	0.48	0.39	1.18	2.03	2.25	2.47	4.10	5.52	7.84	7.25
2000	3.21	4.17	3.93	3.46	4.03	6.30	5.43	5.82	7.03	7.37	4.16
2001	3.10	3.74	4.44	5.25	5.55	8.45	9.80	14.72	16.24	18.84	15.74
2002	3.80	5.10	5.65	7.15	9.03	12.00	15.21	18.94	26.41	30.11	26.31
2003	1.68	2.66	3.05	4.04	7.05	10.94	13.31	14.92	18.38	21.53	19.85
2004	1.43	2.97	4.17	7.10	8.69	10.32	13.05	14.15	16.08	12.93	11.50
2005	0.71	1.42	2.20	3.37	4.29	5.80	7.75	9.16	8.42	10.01	9.30
2006	1.43	2.77	3.85	5.16	6.95	10.19	12.60	14.34	17.20	16.71	15.27
2007	5.88	5.24	7.40	9.06	11.30	13.52	14.95	17.11	19.96	22.35	16.47
2008	9.50	11.99	13.32	14.60	18.27	19.46	20.05	22.53	28.13	30.03	20.54
2009	7.27	9.21	11.50	16.12	18.90	21.97	25.28	29.10	32.25	35.32	28.05
2010	2.75	5.97	10.70	18.99	21.67	23.54	25.64	31.60	35.80	38.37	35.62
2011	6.80	10.50	13.62	19.33	23.94	29.86	32.85	36.41	39.95	41.81	35.01
2012	2.83	3.30	7.23	12.71	14.71	17.43	17.21	19.76	22.96	24.49	21.66
2013	0.86	0.76	2.72	4.55	4.98	7.30	7.24	8.89	9.41	9.64	8.78
2014	3.34	4.00	4.79	7.19	7.73	9.61	12.27	17.06	23.36	25.11	21.77
2015	3.25	4.17	5.51	7.95	9.22	12.01	13.37	16.49	19.97	22.13	18.88

This table provides average integration estimates for ten decile portfolios sorted by size. In each year, we organise stocks into size-sorted decile portfolios based on end-of-year firm market capitalization. We then calculate average integration for each portfolio using our adjusted-R^2 integration measures for each stock. The portfolios are ordered from smallest to largest. The final column (10-1) gives the difference in average integration between portfolio 10 (largest) and portfolio 1 (smallest).

Table 5: Industry Classification

	Industry	Description
1.	Food	Food Products
2.	Beer	Beer & Liquor
3.	Smoke	Tobacco Products
4.	Games	Recreation
5.	Books	Printing and Publishing
6.	Hshld	Consumer Goods
7.	Clths	Apparel
8.	Hlth	Healthcare, Medical Equipment, Pharmaceutical Products
9.	Chems	Chemicals
10.	Txtls	Textiles
11.	Cnstr	Construction and Construction Materials
12.	Steel	Steel Works Etc.
13.	FabPr	Fabricated Products and Machinery
14.	ElcEq	Electrical Equipment
15.	Autos	Automobiles and Trucks
16.	Carry	Aircraft, Ships, and Railroad Equipment
17.	Mines	Precious Metals, Non-Metallic, and Industrial Metal Mining
18.	Coal	Coal
19.	Oil	Petroleum and Natural Gas
20.	Util	Utilities
21.	Telcm	Communication
22.	Servs	Personal and Business Services
23.	BusEq	Business Equipment
24.	Paper	Business Supplies and Shipping Containers
25.	Trans	Transportation
26.	Whlsl	Wholesale
27.	Rtail	Retail
28.	Meals	Restaraunts, Hotels, Motels
29.	Fin	Banking, Insurance, Real Estate, Trading
30.	Other	Everything Else

This table lists the 30 industries into which we sort firms. We follow the classification system suggested by Ken French and make use of four-digit Standard Industrial Classification (SIC) codes for each stock. The full details of this classification system are available at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Table 6: Integration by Industry (equal-weighted average)

Panel A

Year	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
1974	11.66	12.16	12.28	9.50	6.50	11.05	6.18	12.69	13.07	8.69
1975	5.58	5.53	4.85	3.74	7.80	4.86	1.94	6.18	2.55	1.82
1976	3.86	6.15	9.58	10.31	10.00	8.35	8.02	8.14	11.61	7.24
1977	0.64	2.88	0.18	0.39	4.83	−0.14	0.49	1.64	2.16	−0.77
1978	4.35	−1.62	−0.33	0.88	3.36	2.58	0.20	3.70	1.93	3.74
1979	3.07	−0.71	0.80	3.14	7.35	3.60	0.69	5.86	5.10	0.93
1980	10.52	8.67	15.73	8.78	9.41	9.76	5.12	9.74	10.35	9.83
1981	4.61	5.30	5.53	6.69	5.69	4.98	3.01	4.08	5.79	2.83
1982	7.47	3.48	11.50	5.75	10.15	6.34	11.12	8.04	9.96	7.81
1983	−0.77	−0.43	3.24	2.93	1.75	1.53	2.54	0.27	1.89	0.49
1984	3.90	2.55	8.31	2.60	3.95	5.15	5.02	5.40	7.02	4.09
1985	1.83	−2.29	3.77	−0.92	0.65	1.59	0.95	2.26	−1.10	−1.75
1986	1.53	6.97	8.00	0.30	2.87	3.15	−0.52	1.59	3.78	2.26
1987	33.82	20.23	35.96	35.19	37.98	36.51	36.58	32.56	47.20	35.33
1988	8.75	14.43	4.46	5.42	11.03	11.52	6.54	6.48	14.83	11.84
1989	1.29	4.65	14.90	3.50	3.65	3.88	0.29	1.15	4.79	3.86
1990	12.03	15.69	11.40	7.57	11.72	13.58	10.69	11.20	17.03	9.30
1991	5.90	13.29	16.43	6.52	10.12	8.25	6.14	6.97	10.34	11.88
1992	−0.24	0.07	5.29	−2.30	−1.13	−1.16	1.61	−0.06	0.75	2.25
1993	0.47	−0.32	4.54	−1.03	−0.21	−0.39	−0.38	−0.27	0.59	1.60
1994	3.07	1.58	15.08	3.41	6.38	4.91	2.73	2.89	6.35	5.44
1995	0.45	2.26	0.54	−0.33	2.71	1.15	1.29	0.20	4.58	−2.16
1996	4.08	3.84	3.12	2.40	6.80	3.73	2.71	2.65	4.91	4.15
1997	3.96	4.33	4.03	2.35	4.97	4.40	2.86	2.58	4.75	2.90
1998	5.51	5.51	−3.61	4.91	8.63	7.90	4.93	5.76	8.19	3.53
1999	0.48	2.18	1.08	1.81	3.49	4.02	1.04	1.22	3.19	1.63
2000	1.56	0.12	2.94	4.38	3.22	3.46	0.83	4.48	3.39	4.53
2001	2.47	−3.22	7.30	6.75	9.27	8.46	4.96	8.10	8.09	4.79
2002	7.58	9.44	24.48	9.82	20.05	11.42	12.83	7.79	13.39	11.51
2003	7.17	4.17	0.22	7.32	14.08	9.36	7.53	6.59	12.69	4.24
2004	4.56	5.93	17.21	6.29	11.44	9.63	5.62	5.91	11.54	8.70
2005	3.98	1.60	3.78	3.38	4.69	4.40	5.61	1.74	10.49	5.47
2006	6.78	3.91	−1.55	4.91	3.65	7.04	5.95	4.57	13.78	6.72
2007	12.41	10.80	3.87	11.71	14.35	9.56	11.41	8.44	16.41	10.15
2008	13.01	8.80	17.06	20.22	24.25	16.95	16.61	12.67	23.27	18.59
2009	14.74	18.48	18.71	23.67	20.62	22.41	23.24	11.62	28.51	24.56
2010	15.52	17.90	28.92	17.23	26.27	20.90	29.49	15.68	31.66	18.21
2011	21.97	24.55	27.43	24.16	27.21	25.65	21.46	18.86	42.19	25.59
2012	6.19	9.33	5.27	11.14	11.46	10.37	11.06	8.92	25.69	13.45
2013	4.40	3.14	7.31	5.67	3.27	5.78	2.76	1.76	10.43	5.85
2014	10.24	10.50	11.54	7.10	14.01	9.37	6.54	8.47	19.37	10.40
2015	8.19	10.19	7.87	12.11	16.45	11.61	5.33	7.015	24.73	8.36

Panel B

Year	Cnstr	Steel	FabPr	ElecEq	Autos	Carry	Mines	Coal	Oil	Util
1974	10.01	10.22	10.23	11.46	8.75	11.34	6.73	4.72	12.51	8.46
1975	6.21	2.59	4.25	5.92	4.86	2.20	1.72	−6.99	2.07	0.90
1976	9.08	11.37	9.60	11.20	9.10	7.19	4.28	1.73	3.91	7.33
1977	1.23	1.76	0.58	1.87	0.74	1.92	0.43	−3.35	0.81	1.01
1978	3.16	5.21	3.68	4.35	3.56	4.33	6.01	−2.85	3.79	2.89
1979	4.62	7.64	3.54	5.92	2.50	8.23	6.76	1.69	6.47	4.06
1980	9.27	10.90	8.44	5.38	7.84	9.98	15.84	6.89	10.29	11.63
1981	6.32	2.53	4.80	7.66	5.14	5.46	8.74	5.44	3.50	8.47
1982	12.02	8.50	7.37	5.72	10.36	4.90	15.26	6.78	10.58	10.22
1983	3.63	3.30	0.82	−0.86	3.07	2.09	8.09	0.06	9.14	1.09
1984	8.33	8.56	4.93	7.24	10.46	4.86	14.25	−0.64	3.52	3.65
1985	0.21	2.82	0.74	1.67	−0.66	−3.38	5.94	0.76	0.39	4.26
1986	3.02	2.04	1.82	1.64	1.51	1.51	−0.59	1.49	2.17	2.41
1987	33.33	41.57	40.98	36.31	43.41	37.41	34.21	25.45	27.67	19.24
1988	7.57	12.18	7.43	7.78	13.12	7.40	8.85	7.25	7.06	3.60
1989	2.56	0.93	3.51	2.58	3.77	2.95	3.81	7.31	4.43	1.99
1990	12.71	12.01	11.33	5.33	17.97	11.31	3.95	8.01	3.19	6.46
1991	9.82	10.66	11.02	7.97	11.03	8.21	4.71	12.36	9.58	4.79
1992	1.44	1.97	0.54	0.69	2.98	−0.88	4.05	−2.28	−0.46	2.95
1993	−0.28	0.67	−0.22	−1.30	0.14	1.48	2.17	1.34	1.92	1.30
1994	7.28	9.81	4.26	3.00	8.00	7.47	5.01	2.54	4.01	4.39
1995	2.05	5.48	1.61	1.65	3.02	1.80	8.63	2.82	2.25	0.83
1996	4.87	3.60	4.21	2.71	5.06	5.19	1.80	1.87	2.14	9.20
1997	4.89	5.36	6.66	4.61	4.75	9.12	2.99	1.82	3.04	2.37
1998	8.04	9.99	10.06	7.29	8.29	8.10	3.22	3.94	7.55	0.83
1999	2.17	5.08	3.74	2.94	2.21	1.81	4.72	2.87	1.42	0.34
2000	5.03	3.50	4.20	9.68	2.12	0.99	5.39	3.96	0.26	1.65
2001	7.18	10.59	11.32	14.30	10.93	3.31	5.01	8.98	4.45	2.03
2002	13.47	17.71	17.52	12.50	18.88	8.40	14.35	33.87	18.55	24.02
2003	7.68	11.98	11.66	9.78	15.12	14.17	15.23	4.95	5.47	12.06
2004	8.27	16.28	12.37	11.43	13.17	11.77	24.81	33.28	7.83	17.47
2005	6.43	15.66	8.25	3.98	9.83	7.72	17.03	16.28	19.20	11.73
2006	15.80	24.12	15.46	8.91	10.67	17.20	34.95	30.17	31.30	19.59
2007	18.21	21.74	15.67	11.40	17.17	14.68	25.94	19.99	19.75	21.05
2008	26.10	35.48	30.28	20.45	24.28	27.54	36.52	40.27	41.52	24.00
2009	28.94	40.83	33.53	22.09	29.47	31.04	27.24	54.01	40.08	24.88
2010	27.22	40.04	33.58	22.67	35.23	37.34	30.50	45.95	34.05	30.08
2011	32.61	40.34	37.69	28.46	34.44	43.02	36.48	42.27	38.27	37.36
2012	21.49	31.60	23.34	14.07	27.14	24.45	27.12	32.86	21.34	6.41
2013	11.47	18.64	10.56	6.13	13.30	7.19	20.53	23.70	10.07	5.54
2014	15.80	21.78	22.15	11.67	22.64	22.70	8.14	14.93	15.09	11.54
2015	12.73	21.52	20.13	13.49	23.21	20.08	12.35	10.84	21.93	8.64

Panel C

Year	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
1974	16.08	7.81	13.38	12.11	11.90	10.81	8.97	5.53	9.99	12.27
1975	8.86	4.47	5.67	4.50	8.18	6.18	4.95	8.74	3.33	2.73
1976	11.12	9.27	9.63	9.23	9.63	7.30	7.60	8.61	8.61	8.64
1977	−3.08	1.10	2.97	2.99	1.72	1.76	1.97	1.25	1.13	1.76
1978	3.22	2.44	4.46	3.97	2.28	4.47	3.15	0.00	2.92	3.26
1979	5.13	2.92	3.64	2.28	3.41	2.35	3.86	1.64	5.08	4.06
1980	10.22	8.67	9.68	9.67	8.03	8.35	8.57	10.74	10.27	6.79
1981	7.15	4.80	4.63	6.62	4.09	6.82	5.21	5.06	6.30	4.93
1982	8.57	8.28	9.13	8.66	7.85	9.63	7.10	7.30	9.89	8.20
1983	2.48	0.90	0.97	1.81	2.29	0.94	0.78	2.82	4.04	2.69
1984	5.43	3.62	5.42	6.07	4.83	7.55	3.66	3.82	7.10	2.82
1985	1.29	0.48	1.89	1.38	2.13	0.12	0.72	−1.24	0.60	1.08
1986	5.02	2.80	1.39	3.16	1.43	1.61	2.04	2.29	3.44	0.21
1987	33.77	33.48	34.53	36.33	35.24	35.39	32.86	33.03	30.80	33.32
1988	8.02	5.72	8.16	15.01	5.59	9.91	6.26	9.02	4.94	6.44
1989	7.05	1.88	2.59	5.39	3.57	3.00	4.54	3.64	1.81	1.21
1990	9.94	9.66	9.66	14.00	13.13	9.67	12.41	10.19	7.62	10.91
1991	10.26	6.43	8.70	14.18	12.72	8.16	10.50	10.99	8.59	6.20
1992	0.65	0.25	0.44	1.13	1.06	−1.00	−0.13	−0.72	−0.09	0.31
1993	2.67	−0.15	0.10	0.39	−0.31	0.41	1.09	0.34	0.98	0.98
1994	6.44	3.49	4.60	7.09	5.50	3.19	3.00	5.24	5.05	3.06
1995	2.86	1.19	1.03	3.85	2.05	0.78	1.26	1.46	2.89	1.88
1996	4.81	2.01	3.50	3.56	4.06	2.38	1.54	2.31	6.08	2.82
1997	2.91	3.54	4.59	4.56	4.98	2.52	2.50	2.60	7.33	2.89
1998	9.11	6.62	6.43	10.24	7.23	6.01	6.66	7.27	10.96	6.01
1999	8.13	2.73	4.52	4.66	1.99	0.79	2.32	0.54	2.92	2.26
2000	13.40	7.96	9.41	2.51	4.46	3.32	3.09	2.20	2.55	3.12
2001	11.48	11.43	17.73	11.35	9.05	6.13	7.60	4.85	5.33	6.88
2002	17.64	10.99	15.07	20.67	15.76	11.04	13.54	10.36	14.61	7.85
2003	15.21	8.59	10.75	15.58	13.31	9.17	11.43	8.40	10.36	6.85
2004	11.35	8.76	12.25	8.89	10.96	7.89	7.56	6.54	7.53	8.44
2005	4.95	3.23	3.83	8.29	6.30	4.85	3.77	3.29	5.73	3.52
2006	5.78	6.97	9.52	11.93	13.54	7.76	7.44	6.34	6.24	8.39
2007	14.28	10.76	10.01	20.90	16.51	13.33	13.04	13.22	12.19	10.49
2008	21.38	17.67	20.72	23.95	18.58	17.75	14.96	17.70	12.79	19.81
2009	21.42	16.93	20.62	31.29	28.93	22.18	22.03	22.90	15.77	18.19
2010	23.35	17.52	21.24	28.49	25.47	22.03	22.41	18.71	17.03	17.56
2011	28.24	23.54	23.92	33.46	27.92	30.60	19.89	25.25	21.60	17.23
2012	15.89	12.74	17.10	22.40	17.00	14.54	10.85	15.08	13.25	8.32
2013	4.00	4.22	4.37	8.03	7.31	5.98	5.19	2.94	5.71	3.08
2014	13.47	10.17	13.78	13.90	16.22	14.31	8.91	12.44	10.37	6.34
2015	12.90	11.581	12.59	17.60	15.22	13.92	6.46	9.46	10.30	7.09

This table shows the yearly average integration time series for each of our 30 industry portfolios in the period 1974 to 2015. We assign stocks into industries each year using four-digit Standard Industrial Classification (SIC) codes. We then calculate equal-weighted average integration for all stocks within each industry portfolio.

Table 7: Integration by Industry (value-weighted average)

Panel A

Year	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
1974	16.91	17.12	15.85	13.762	6.84	10.85	7.71	15.20	12.78	7.06
1975	8.73	9.02	0.10	7.86	10.77	7.84	5.06	5.28	5.86	6.83
1976	5.70	5.85	6.67	16.64	12.32	11.10	10.45	5.59	17.34	4.52
1977	1.47	2.98	−0.46	3.32	2.12	0.41	0.59	4.34	0.91	−2.33
1978	2.22	−0.30	0.74	3.57	4.04	1.65	1.47	4.09	3.37	1.50
1979	2.70	−1.44	8.43	9.29	5.18	3.83	1.82	9.16	3.54	0.00
1980	13.57	16.03	14.19	10.14	11.60	20.27	12.06	19.25	15.09	11.01
1981	3.05	2.16	16.77	10.62	4.47	5.77	4.81	6.98	12.26	0.73
1982	6.77	8.38	12.31	7.63	16.14	6.07	15.53	7.76	12.24	8.91
1983	−0.80	−0.07	4.46	−1.92	−0.09	−2.37	−0.27	−0.84	6.88	−1.39
1984	5.89	5.44	4.66	6.28	6.24	12.37	7.87	10.31	8.86	4.49
1985	4.14	−3.75	−5.39	−1.78	2.57	−1.27	0.76	2.89	−0.12	0.81
1986	7.06	5.11	11.97	5.98	2.78	8.57	0.53	7.77	8.34	0.60
1987	32.84	25.07	38.21	50.30	38.05	40.38	46.36	38.72	51.51	29.68
1988	16.39	17.12	3.91	21.36	15.28	25.10	5.71	21.20	28.60	13.03
1989	0.44	1.76	5.48	4.25	6.55	7.87	2.35	3.79	12.96	1.79
1990	29.97	28.72	23.39	23.12	20.91	31.87	19.99	27.44	21.64	9.67
1991	7.76	21.01	23.15	20.36	17.56	23.67	10.81	18.93	27.19	11.38
1992	−0.79	10.70	14.98	0.76	1.71	4.38	3.26	2.74	8.17	1.08
1993	4.02	1.62	12.07	−4.11	−4.96	−0.37	−0.92	1.12	5.99	2.41
1994	7.00	1.25	7.92	17.30	11.99	13.93	4.15	11.52	29.86	4.96
1995	−1.03	−6.03	4.05	3.15	4.58	2.71	3.85	1.35	13.82	0.49
1996	9.39	13.14	−3.87	14.46	14.19	17.87	5.63	15.36	12.27	7.05
1997	15.26	0.27	1.47	3.62	9.92	24.91	4.00	14.53	10.46	−0.61
1998	9.06	1.65	−4.32	6.97	10.48	14.71	9.59	9.12	12.41	7.33
1999	−1.50	2.91	3.35	3.96	13.34	18.66	2.13	4.04	10.91	0.39
2000	5.46	9.64	0.25	21.89	2.23	17.74	−2.19	5.91	2.87	3.16
2001	0.82	−4.16	10.67	16.76	13.78	10.63	7.12	10.11	21.44	13.34
2002	6.60	13.13	25.69	29.20	30.24	14.00	30.73	23.97	27.92	38.94
2003	20.07	10.05	4.41	23.04	19.46	14.32	12.32	12.07	27.95	11.50
2004	13.79	2.77	34.50	19.09	12.54	7.87	7.50	3.77	19.45	16.06
2005	6.25	−4.10	−0.26	5.10	8.36	8.87	6.56	3.10	15.55	12.31
2006	9.90	10.94	−0.91	6.18	0.97	2.47	7.66	2.52	21.66	15.94
2007	14.63	11.87	8.42	26.65	23.60	17.11	18.08	18.04	35.67	12.72
2008	12.89	14.62	23.94	39.84	43.76	16.83	19.63	15.54	32.25	24.27
2009	23.63	28.21	23.59	45.96	42.85	21.53	30.76	19.46	41.94	37.84
2010	25.56	32.23	38.99	40.92	52.07	20.23	47.45	30.02	42.08	35.45
2011	42.31	37.00	34.76	51.74	46.97	32.25	19.15	37.33	52.00	32.17
2012	9.52	18.95	6.49	23.28	23.01	5.51	18.21	17.72	34.10	15.80
2013	9.27	6.36	12.06	10.83	8.58	10.63	4.08	5.48	15.41	7.59
2014	11.33	26.56	16.23	33.06	21.88	11.46	11.40	20.95	30.68	21.73
2015	17.62	10.54	10.10	18.57	27.13	14.05	6.81	23.60	30.31	16.91

Panel B

Year	Cnstr	Steel	FabPr	ElecEq	Autos	Carry	Mines	Coal	Oil	Util
1974	13.92	9.54	14.05	6.84	0.59	10.23	6.93	8.74	13.46	12.18
1975	6.91	1.26	4.62	12.53	8.39	0.71	1.02	−7.34	0.72	−1.45
1976	7.36	16.18	10.07	7.12	2.04	10.65	5.53	3.31	4.82	7.87
1977	0.63	0.93	−0.08	−0.38	2.13	2.02	−1.03	−2.29	0.24	−0.53
1978	5.78	6.08	4.58	11.70	1.81	1.52	4.88	−3.53	4.26	3.39
1979	3.65	10.58	3.78	2.23	4.19	9.21	9.56	3.7	4.50	5.37
1980	12.49	16.63	8.74	11.63	5.49	6.67	16.10	9.16	11.18	12.64
1981	10.80	5.31	8.06	7.15	12.58	5.16	1.46	2.42	2.69	6.43
1982	14.95	13.33	13.39	3.18	8.56	6.78	17.38	4.66	15.54	11.28
1983	5.16	0.56	1.40	−3.20	−0.04	1.62	13.65	0.92	25.87	2.02
1984	12.47	11.66	10.67	25.50	17.51	7.42	22.63	3.52	6.31	5.16
1985	−1.10	−0.57	1.34	0.78	−2.52	−3.29	8.35	−0.27	3.74	6.21
1986	2.44	1.06	−0.20	0.81	0.60	6.68	1.21	4.13	8.64	2.97
1987	44.04	45.30	47.83	43.98	43.87	49.47	38.83	32.15	30.00	19.15
1988	14.17	25.68	18.05	19.78	16.09	8.54	24.90	4.07	13.23	4.33
1989	9.55	7.77	4.61	9.63	11.13	10.09	7.73	15.61	8.54	3.88
1990	26.88	21.94	19.01	19.00	22.51	26.81	9.67	7.97	1.10	11.44
1991	18.21	20.09	18.30	18.49	11.61	7.15	9.50	15.16	20.79	5.99
1992	7.61	7.72	3.07	5.73	8.96	−3.31	1.34	−1.26	−5.16	4.75
1993	−1.75	2.44	−1.07	−1.70	−0.41	4.00	1.07	−2.33	8.83	0.43
1994	19.40	16.02	10.92	9.94	10.48	12.54	17.55	1.15	10.72	5.22
1995	6.83	7.30	6.82	4.87	2.24	2.49	17.35	4.62	2.84	0.52
1996	13.83	5.21	10.35	13.19	10.96	10.17	6.32	1.64	4.84	12.91
1997	11.18	10.12	17.63	14.87	10.30	22.64	10.38	4.15	12.19	−0.28
1998	17.88	16.25	19.04	13.84	21.80	29.23	8.22	2.91	6.42	−1.05
1999	3.34	10.49	13.94	11.76	10.10	7.72	6.13	0.99	3.66	−0.17
2000	8.33	8.72	7.11	16.84	4.80	−2.48	5.86	2.52	−3.87	3.32
2001	19.39	28.08	25.54	21.15	17.53	18.90	2.94	6.31	7.84	−0.18
2002	13.21	46.08	31.94	33.98	32.35	17.66	26.30	44.20	44.36	27.72
2003	14.43	31.10	23.78	22.79	29.21	36.56	23.03	5.88	21.98	14.61
2004	12.98	24.14	19.69	12.68	17.81	16.35	32.00	40.56	10.44	18.13
2005	7.04	17.17	17.68	1.06	16.30	0.69	25.19	18.33	31.04	16.36
2006	26.79	29.34	26.46	2.69	15.36	17.08	51.03	42.05	44.20	23.25
2007	27.47	31.01	23.27	40.13	21.83	21.86	39.64	33.05	31.31	25.68
2008	34.89	42.49	41.29	32.43	32.32	43.34	45.48	45.53	58.92	27.92
2009	42.34	51.32	48.34	41.99	40.78	47.27	51.92	62.22	46.54	30.28
2010	41.50	52.27	49.62	41.17	49.17	52.53	56.02	58.98	59.03	33.09
2011	47.02	49.86	58.77	43.16	39.18	61.18	43.73	50.77	52.83	42.04
2012	29.23	36.28	40.96	30.65	33.78	40.52	41.56	36.59	41.65	3.50
2013	17.24	21.14	23.41	21.06	15.41	11.35	44.33	25.51	17.91	2.98
2014	32.95	33.27	36.15	31.72	37.36	42.93	30.67	21.86	31.44	11.51
2015	17.02	24.92	37.95	30.83	37.37	35.39	32.75	21.70	41.24	7.94

Panel C

Year	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
1974	14.91	8.71	9.50	16.46	11.89	13.41	18.41	12.75	13.37	14.62
1975	4.82	6.74	4.31	0.53	7.55	9.67	14.74	11.64	2.37	1.21
1976	7.51	6.68	22.71	4.54	8.38	8.62	2.65	11.24	9.93	7.20
1977	−7.34	1.63	9.92	3.25	−0.31	5.06	0.89	3.37	1.44	0.26
1978	−0.79	2.44	−0.08	3.41	2.88	5.29	2.56	2.96	3.87	6.04
1979	−4.03	1.64	6.39	0.24	3.34	6.22	2.24	0.04	6.70	4.71
1980	15.56	8.43	14.24	13.12	8.75	9.06	11.95	16.03	11.29	8.44
1981	−0.79	8.04	10.73	12.14	3.68	6.25	4.80	5.13	8.15	6.53
1982	7.27	13.77	13.45	12.85	9.47	12.75	8.30	11.00	12.95	12.71
1983	0.14	0.26	2.53	7.18	0.41	1.73	−1.00	0.07	5.41	1.58
1984	0.77	5.42	14.23	6.97	6.78	11.53	4.86	4.65	9.46	5.16
1985	−2.90	0.55	−1.17	−0.16	4.21	0.10	−0.58	−1.77	0.29	2.29
1986	8.49	6.07	2.98	5.93	−0.29	3.61	1.54	5.62	6.56	2.25
1987	24.02	41.20	45.21	48.54	47.91	45.08	42.51	31.65	37.06	36.04
1988	4.48	15.88	20.40	20.37	11.74	17.40	16.46	6.25	8.62	14.04
1989	5.04	2.01	5.38	7.98	9.13	3.02	9.63	4.97	4.20	8.46
1990	7.40	14.21	27.28	31.21	20.55	15.52	24.95	23.30	14.85	26.06
1991	14.62	10.66	17.98	23.08	16.34	14.13	11.76	10.38	17.47	15.62
1992	2.53	0.66	3.77	4.98	6.46	2.86	−0.39	−1.00	2.46	−1.15
1993	0.24	−1.21	−2.02	−1.53	−0.82	−0.55	1.81	−3.49	1.32	4.34
1994	10.88	8.53	8.94	14.19	12.62	8.73	7.26	8.10	15.82	16.64
1995	2.65	0.26	0.36	4.20	3.02	3.34	−0.39	6.22	9.39	3.81
1996	17.52	3.85	9.72	8.18	9.83	7.30	4.42	7.56	20.43	9.93
1997	6.33	7.21	12.25	10.51	11.81	7.56	4.24	2.71	18.76	7.49
1998	12.17	12.69	11.45	15.40	13.26	10.48	7.77	7.61	24.31	12.70
1999	14.50	8.36	14.67	8.56	10.38	1.50	4.35	1.02	12.26	4.63
2000	14.78	12.35	15.42	6.98	7.96	9.16	5.17	−0.96	8.64	4.61
2001	13.96	25.84	40.68	25.32	13.41	12.36	24.52	10.62	26.83	16.39
2002	43.39	31.50	32.07	28.30	25.23	21.10	16.70	22.34	44.92	15.09
2003	26.58	20.51	24.82	17.23	26.16	16.23	15.06	17.91	34.89	19.69
2004	11.08	11.83	14.44	7.87	14.84	8.55	2.58	10.12	15.35	11.44
2005	9.40	5.21	7.39	11.30	13.01	6.08	3.55	8.27	7.01	4.93
2006	12.29	8.04	17.04	16.56	15.31	10.35	12.00	8.28	17.29	19.04
2007	18.62	20.14	19.21	26.84	26.61	18.71	21.62	23.31	26.16	14.03
2008	28.93	23.54	32.86	26.89	23.43	25.36	16.14	17.74	25.43	36.92
2009	25.93	25.02	38.75	37.21	46.22	30.58	27.21	24.50	36.96	26.54
2010	32.28	35.56	38.95	38.33	47.21	28.63	24.53	27.35	38.29	46.51
2011	33.78	36.80	43.29	46.05	42.29	43.47	28.55	30.05	48.08	30.42
2012	20.78	26.83	30.76	19.84	30.81	17.90	10.34	23.16	33.59	17.17
2013	7.10	11.05	6.89	11.69	10.56	6.11	5.59	5.26	13.25	5.57
2014	22.89	21.43	29.41	21.63	24.74	25.79	14.08	19.20	28.86	13.47
2015	17.37	20.94	25.43	27.77	20.19	20.69	9.74	20.22	25.95	18.03

This table shows the yearly average integration time series for each of our 30 industry portfolios in the period 1974 to 2015. We assign stocks into industries each year using four-digit Standard Industrial Classification (SIC) codes. We then calculate value-weighted average integration for all stocks within each industry portfolio using end-of-year firm market capitalizations.

Table 8: Integration time trends

Panel A: Average series

	EW-Avg.	VW-Avg.
Full sample	2.804***	4.856***
Ex-1987	4.176***	5.851***

Panel B: Quintile size portfolios

	1	2	3	4	5	5-1
Full sample	-0.016	1.176	2.437**	3.530***	4.544***	6.915***
Ex-1987	0.713	2.343**	3.704***	4.888***	5.639***	7.205***

Panel C: Decile Size portfolios

	1	2	3	4	5	6	7	8	9	10	10-1
Full sample	-0.157	0.091	0.708	1.560	2.024**	2.831***	3.185***	3.832***	4.441***	4.614***	6.519***
Ex-1987	0.450	0.907	1.811*	2.706***	3.266***	4.090***	4.556***	5.151***	5.610***	5.615***	6.856***

Panel D: Industry portfolios (equal-weighted)

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Full sample	1.453	1.857*	1.136	2.235**	2.510**	2.195**	2.214**	0.802	3.462***	2.449**
Ex-1987	2.601**	2.221**	1.660	3.464***	3.646***	3.483***	3.390***	1.714*	4.948***	3.711***

	Cnstr	Steel	FabPr	ElecEq	Autos	Carry	Mines	Coal	Oil	Util
Full sample	3.590***	4.916***	4.320***	2.735***	4.144***	4.010***	4.147***	5.900***	4.383***	3.653***
Ex-1987	4.570***	6.148***	5.756***	4.050***	5.745***	4.958***	4.832***	6.219***	4.789***	3.883***

	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Full sample	2.689**	2.561**	2.713***	3.632***	3.406***	2.575**	2.190**	2.371**	2.285**	1.610
Ex-1987	3.678***	4.105***	3.942***	4.678***	4.668***	3.725***	3.357***	3.449***	3.616***	2.779***

Panel E: Industry portfolios (value-weighted)

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Full sample	2.260**	2.218**	1.697*	3.532***	3.908***	1.602	2.149**	2.131**	4.610***	4.470***
Ex-1987	2.743***	2.441**	2.099**	4.330***	4.395***	2.161**	2.982***	2.729***	5.803***	5.064***

	Cnstr	Steel	FabPr	ElecEq	Autos	Carry	Mines	Coal	Oil	Util
Full sample	4.344***	5.574***	6.332***	4.699***	6.124***	4.994***	6.369***	5.870***	5.532***	3.299***
Ex-1987	5.254***	6.410***	7.651***	5.548***	7.497***	5.840***	6.938***	6.208***	5.723***	3.434***

	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Full sample	5.148***	4.212***	3.713***	3.737***	4.605***	2.994***	1.837*	3.071***	5.442***	3.334***
Ex-1987	5.491***	5.420***	4.425***	4.783***	5.952***	4.080***	2.620**	3.663***	6.158***	3.958***

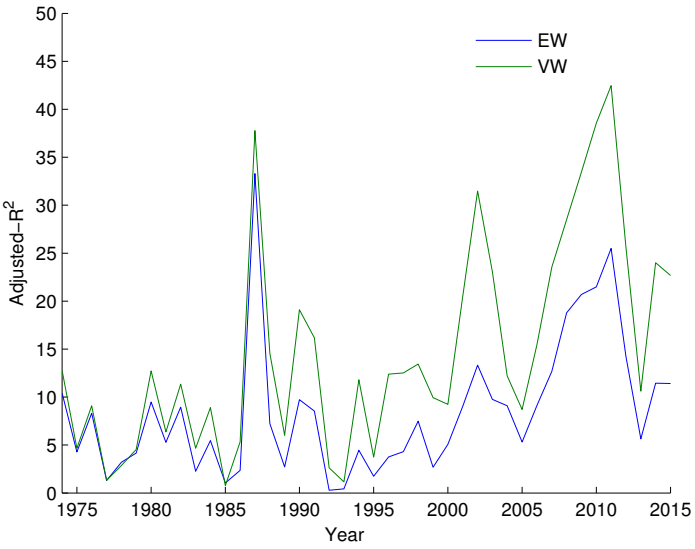
This table provides time-trend t-statistics from regressions of each integration series on time. Panel A shows the t-statistics for equal- and value-weighted average integration series. Panel B and C give time trend results for quintile and decile size-sorted portfolios. Portfolio 1 refers to the portfolio of the smallest firms in both cases and Portfolio 5 (10) refers to the portfolio of the largest firms. Panel D and E provide time-trend t-statistics for equal- and value-weighted average integration series for each of 30 industry portfolios. Table 2.5 provides further details on our industry classification system. In all cases, we also a Full Sample statistic referring to the full sample of 1974 to 2015 and an Ex-1987 statistic referring to the same time-trend t-statistic when we exclude 1987.

Table 10: Most integrated firms

Year	Firm 1	$\bar{R}^2$	Firm 2	$\bar{R}^2$	Firm 3	$\bar{R}^2$
1978	Pennwalt Corp.	22.09	Dean Witter Reynolds	20.78	Republic Texas Corp.	19.74
1979	Oneida Ltd.	20.06	Service Merchandise	19.94	Oakwood Homes	19.52
1980	E-Systems Inc.	24.84	Dean Witter Reynolds	19.86	EECO Inc.	19.62
1981	E-Systems Inc.	26.95	EECO Inc.	21.52	Equitable Gas	21.50
1982	Public Serv. Co. of NH	27.55	Equitable Gas Co.	24.23	Amer. Maize-Products	24.22
1983	Asarco Inc.	23.37	Public Serv. Co. of NH	21.71	Newberry Energy	21.68
1984	D, L & J	26.95	Nevada S&L Assoc.	26.92	Radiation Systems	24.68
1985	LTV Corp.	23.40	Asarco	21.79	Callahan Mining	21.07
1986	Contel Corp.	21.33	AMAX	20.15	Exxon	19.48
1987	Contel Corp.	27.17	WMS Industries	26.62	Kuhlman Corp.	26.14
1988	Helen of Troy Corp.	31.59	Norfolk Southern Corp.	30.72	Transcon	30.51
1989	Helen of Troy Corp.	30.69	Consolidated Papers	30.61	Great Lakes Chemical	29.78
1990	Norfolk Southern Corp.	39.46	Great Lakes Chemical	37.60	Wallace Computer	35.45
1991	Norfolk Southern Corp.	44.75	Zurn Industries	44.08	Federal Paper Board	42.92
1992	Norfolk Southern Corp.	34.67	Federal Paper Board	31.05	ITT Corp.	30.43
1993	Norfolk Southern Corp.	26.67	ITT Corp.	25.84	Meredith Corp.	25.20
1994	Du Pont	28.42	Phelps Dodge	26.40	Beneficial Corp.	25.24
1995	Du Pont	31.15	Magma Copper	27.37	Travelers Group	27.29
1996	Du Pont	28.77	Travelers Group	26.17	Occidental Petroleum	23.03
1997	Travelers Group	31.33	Du Pont	29.58	Morgan Stanley DW	28.61
1998	Citigroup	37.20	Summit Bancorp	36.02	Morgan Stanley DW	34.01
1999	Summit Bancorp	31.90	Citigroup	31.29	Textron	29.77
2000	Morgan Stanley DW	32.65	Textron	31.60	Lehman Brothers	31.18
2001	Morgan Stanley DW	39.01	A.G. Edwards	36.73	Lehman Brothers	36.68
2002	Morgan Stanley DW	44.22	Affiliated Managers	42.84	Citigroup	42.35
2003	Morgan Stanley DW	48.58	Affiliated Managers	46.57	Citigroup	45.10
2004	Affiliated Managers	49.49	Citigroup	46.52	JPMorgan Chase	45.56
2005	Affiliated Managers	44.43	American Express	44.10	Citigroup	41.80
2006	Affiliated Managers	45.03	Freeport-McMoRan	40.60	Alcoa	39.86
2007	Affiliated Managers	41.15	Newmont Mining	38.15	Coeur d'Alene Mines	37.43
2008	Freeport-McMoRan	49.41	Southern Copper	46.19	Whiting Petroleum	44.27
2009	Freeport-McMoRan	56.87	Whiting Petroleum	55.28	National Oilwell Varco	54.95
2010	Freeport-McMoRan	62.84	Whiting Petroleum	60.25	Apache	59.87
2011	Apache	61.82	Whiting Petroleum	61.22	Denbury Resources	60.64
2012	Apache	64.88	Denbury Resources	64.02	Alcoa	63.83
2013	Freeport-McMoRan	58.29	Alcoa	57.79	Affiliated Managers	57.47
2014	Leucadia National	55.10	Alcoa	53.58	Fluor	53.04
2015	Fluor	52.35	Caterpillar	50.66	United Technologies	50.58

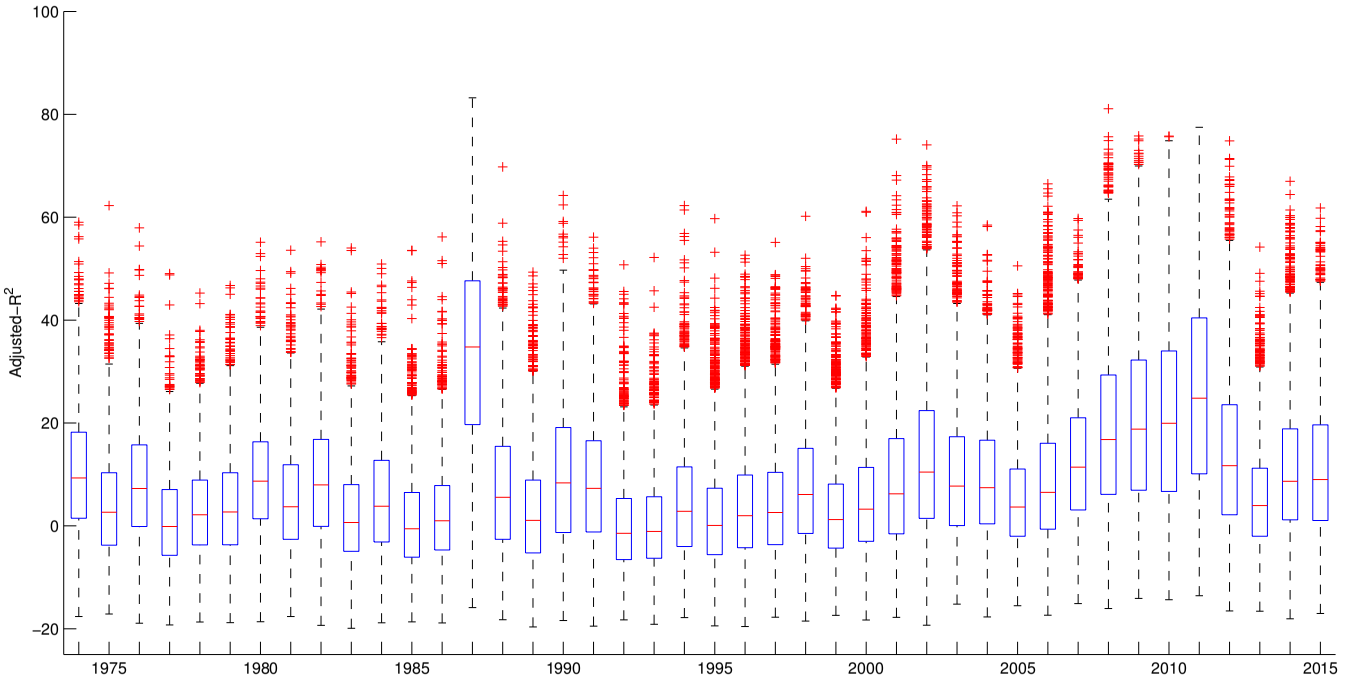
This table shows the three firms with the highest 5-year moving average integration adjusted-R^2 for each year from 1978 to 2015. The moving average for year t is a simple average of the firm's adjusted-R^2 measures from year $t-4$ to year t.

Figure 1: Integration time series



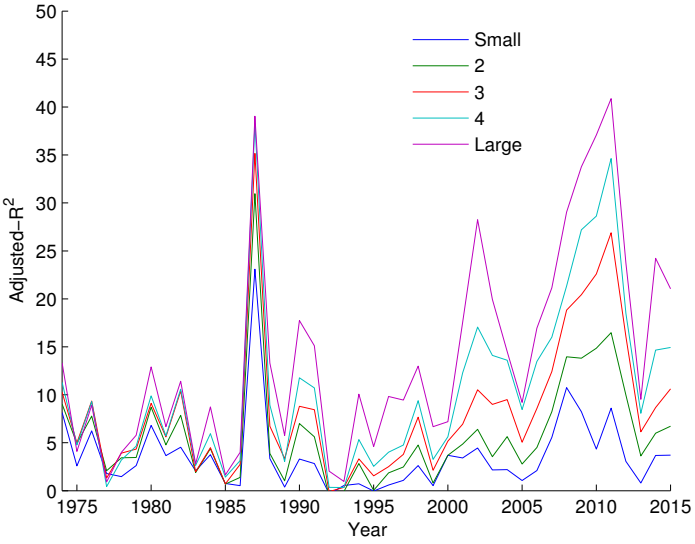
This figure shows yearly equal- and value-weighted average integration time series for our sample of US stocks. The sample period runs from 1974 to 2015. The integration measure for stock i in year t is the adjusted-R^2 from a regression of weekly stock i returns in year t on a set of out-of-sample international equity index-based principal components. We calculate value-weights for each stock using its end-of-year market capitalisation.

Figure 2: Integration in the cross-section



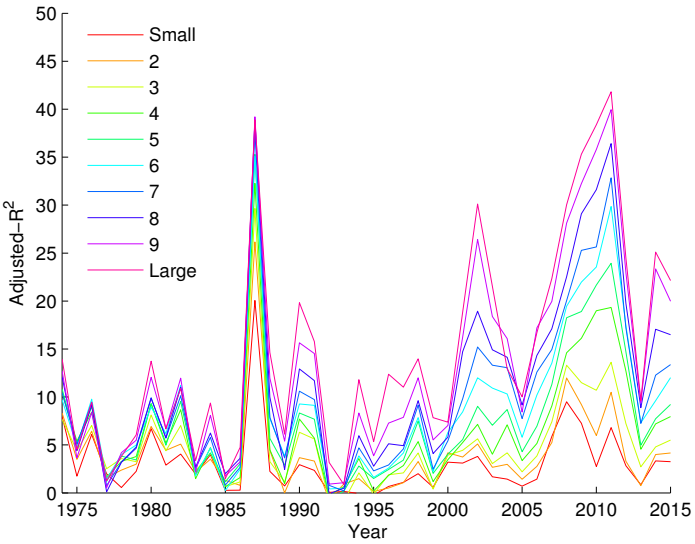
This figure presents boxplots which show the cross-sectional spread in our stock integration estimates in each year from 1974 to 2015. The horizontal line within each box refers to the median for that year. The lower and upper limits of each box refer to the 25th and 75th percentile for a given year, respectively. Thus, the box represents the interquartile range. The vertical lines extending from each box are 1.5 times the length of the given interquartile range. Red crosses are outliers.

Figure 3: Integration time series by size quintile portfolios



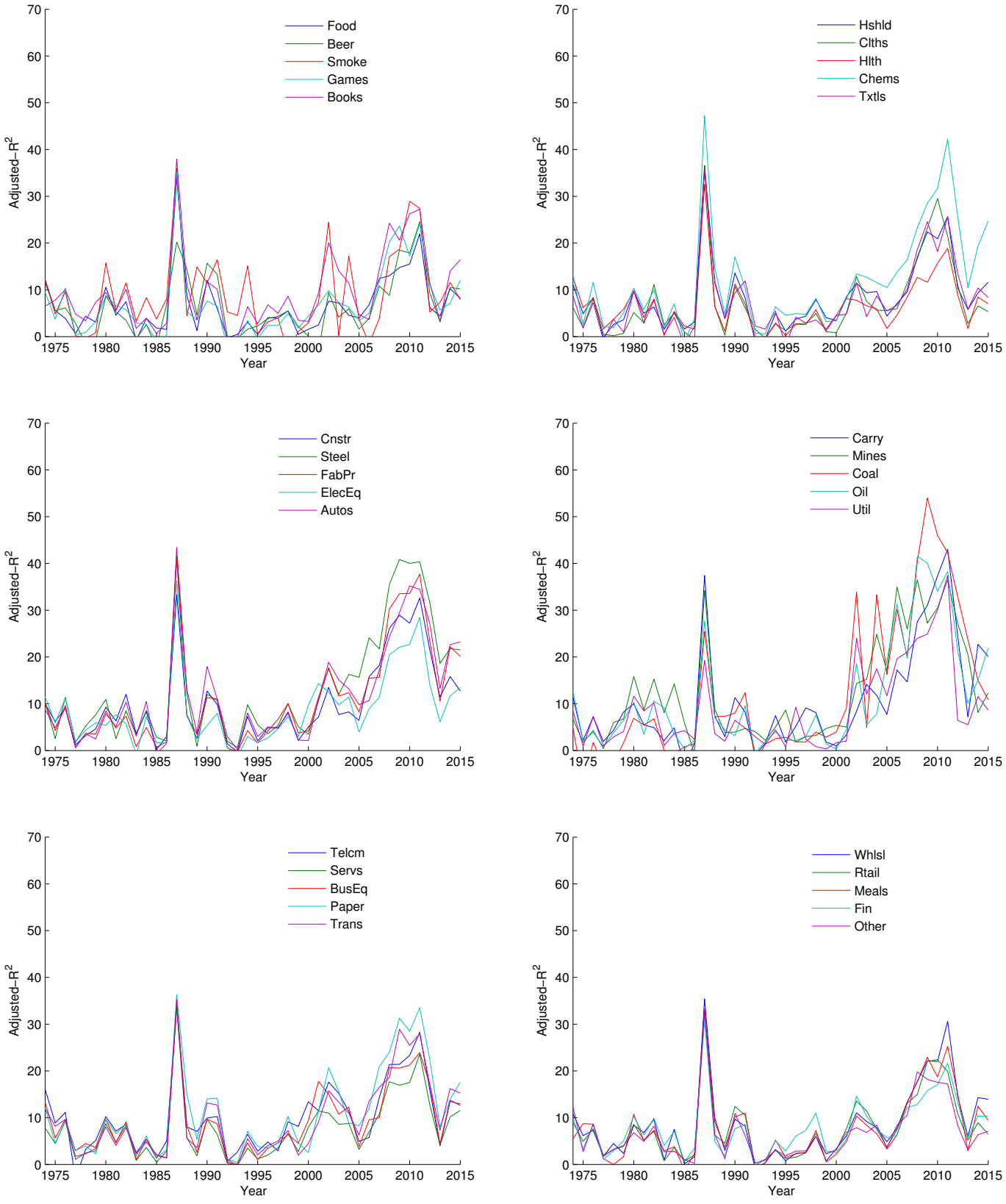
This figure shows the average integration time series for size-based quintile portfolios. In each year, we sort stocks into quintile portfolios based on end-of-year firm market capitalization. We then calculate the average integration estimate of stocks within each of these 5 portfolios.

Figure 4: Integration time series by size decile portfolios



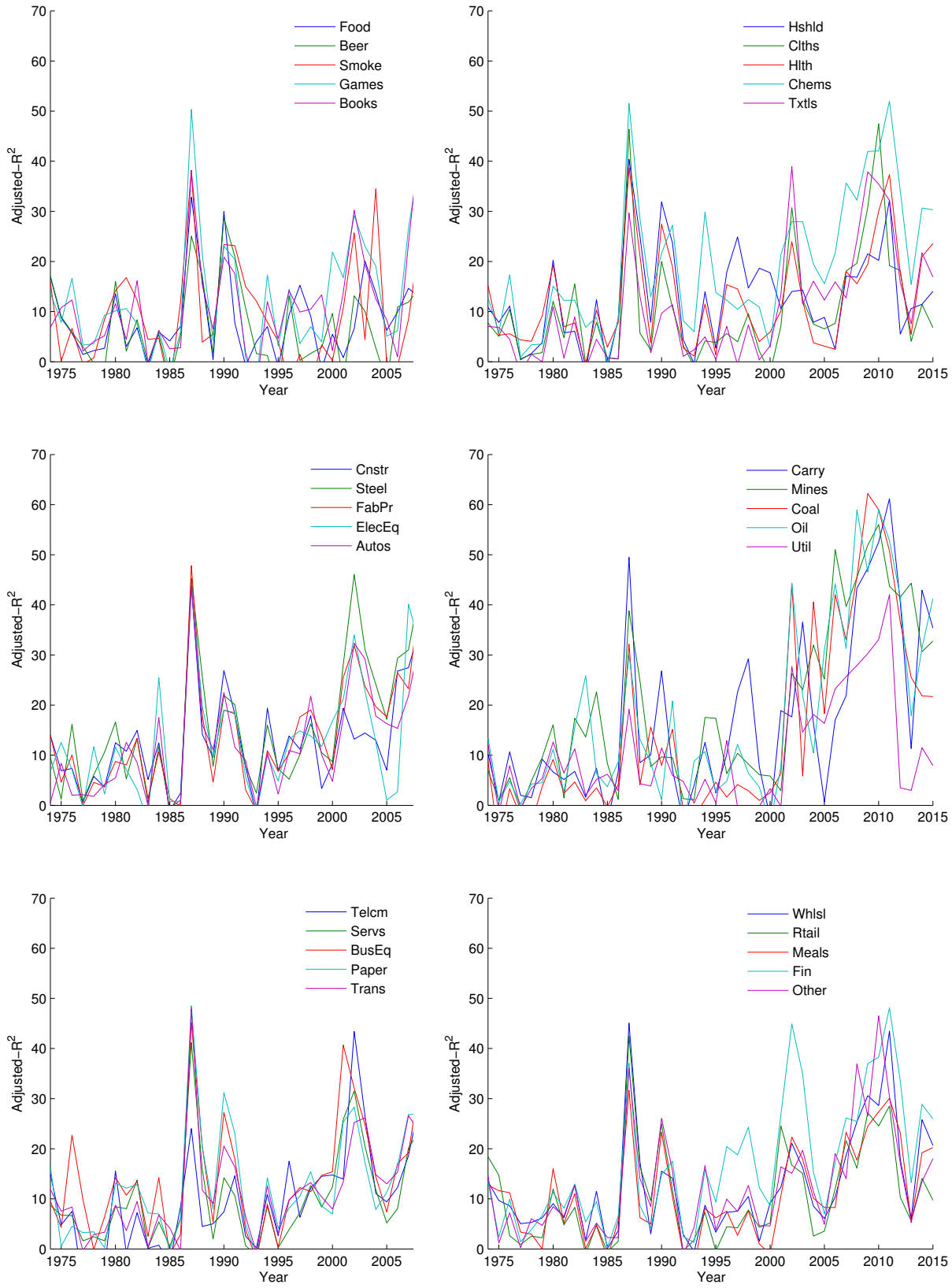
This figure shows the average integration time series for size-based decile portfolios. In each year, we sort stocks into decile portfolios based on end-of-year market capitalization. We then calculate the average integration estimate of stocks within each of these 10 portfolios.

Figure 5: Integration by industry (equal-weighted averages)



This figure shows yearly equal-weighted average integration time series for each of our industry portfolios.

Figure 6: Integration by industry (value-weighted averages)



This figure shows yearly value-weighted average integration time series for each of our industry portfolios.

Appendix A:
How many principal components?

In this section, we discuss how we choose the number of principal components we use in our integration regressions. In short, we allow the data to guide our choice. Our criterion is that the eigenvector weights we use in for our principal component construction must explain approximately 90% of the variation in our international equity index returns. We find that five eigenvectors are typically sufficient to meet this criterion.

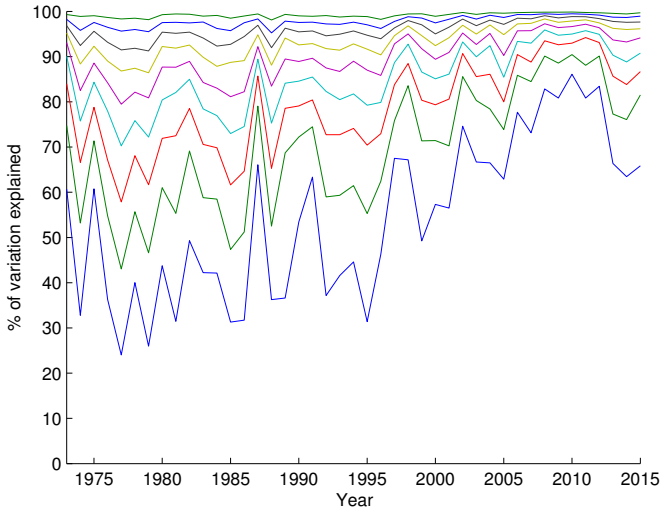
Figure 7 plots yearly time series of the percentage of index return variation explained by each of nine sets of eigenvectors. The first set refers to one eigenvector, the second to two eigenvectors, and so on. We can observe the dynamics of these series clearly as, by construction, they do not overlap. The lowest series refers to one eigenvector, the series above refers to two eigenvectors, and so on. The sample period is 1973 to 2015.

We see that five eigenvectors explain between 80% and 95% of the variation in our ten index returns over the course of the sample period. Additional eigenvectors provide only slight marginal increases. This is especially the case in the latter half of the sample period. We also see evidence of positive time trends in these series. These trends are most pronounced for the series referring to one, two, three, and four eigenvectors and in the period 1995 to 2011. We observe a moderate decline in these series in the final four years of the sample.

Figure 8 is a bar chart showing the time series averages for each of the nine series in Figure 7. Five eigenvectors explain an average of 90% over the variation in our set of international equity returns. Even four eigenvectors explain approximately 84% of the variation. The largest marginal gains come from moving from one eigenvector (54%) to two eigenvectors (70%) and from two to three eigenvectors (79%). Six and seven eigenvectors provide only slight marginal increases relative to five eigenvectors.

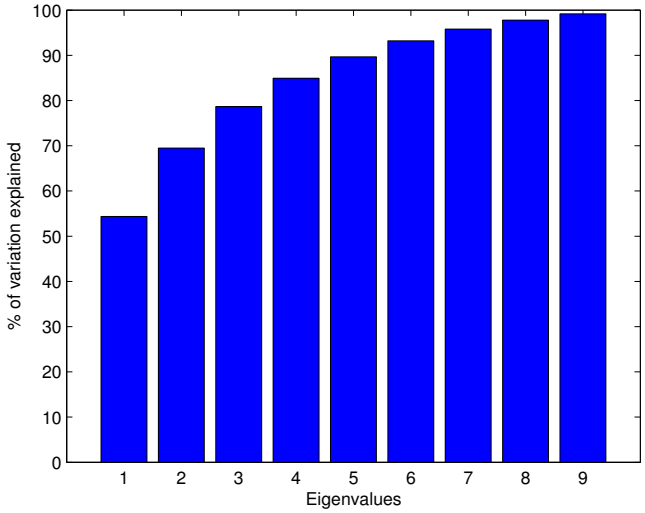
These results demonstrate that five eigenvectors are generally sufficient to meet our criterion. In our methodology, we apply lagged eigenvector weights on index returns. Thus, our five eigenvector weights from year $t-1$ applied to our ten index returns series from year t give us five year t principal components. We then regress individual stock returns on these five principal components to calculate our stock-specific integration measures.

Figure 7: % of index return variation explained by number of eigenvectors



This figure shows yearly time series of the % of variation in our ten equity index returns series which is explained by nine sets of eigenvectors. The first set refers to one eigenvector and is the lowest time series. The next highest series refers to the set of two eigenvectors. The highest series refers to the full set of nine eigenvectors. The sample period is 1973 to 2015.

Figure 8: Average % of index return variation explained by number of eigenvectors



This figure shows the time series average % of variation in our set of ten equity returns which is explained by one to nine eigenvectors. The sample period is 1973 to 2015.

Appendix B:
Most integrated firms by year

Table 11 lists the three firms with the highest adjusted-R^2 in each year from 1974 to 2015. We observe a high degree of turnover in our rankings from year to year. No firm has the highest estimate in any two successive years.

Mining firms have some of the highest integration estimates in later years of our sample period. In 2008, offshore drilling firm Rowan Companies has an adjusted-R^2 of 81.09%. In 2009, Whiting Petroleum is the highest ranked firm with a measure of 75.8%. In 2013, Southern Copper, Coeur Mining, and copper producer Freeport-McMoRan are the top three most integrated firms.

Our year-by-year rankings show more diversity than our study of 5-year moving averages in Table 10. This is unsurprising. We expect that our individual firm regressions produce some noisy estimates. We run a considerable number of regressions and the returns are some of our firms are likely to behave similarly to those of foreign stock indices by sheer chance. This is borne out in the data. In some cases, the adjusted-R^2 for the highest ranked stock is clearly an outlier relative to the neighbouring yearly estimates for that stock. In another case, Sunshine-Jr. Stores has just one valid adjusted-R^2 estimate and this is the highest estimate of all stocks in 1987. We do not wish for large outliers to determine our individual stock rankings. This is the motivation for our 5-year moving average analysis in Table 10.

Table 11: Most integrated firms by year

Year	Firm 1	$\bar{R}^2$	Firm 2	$\bar{R}^2$	Firm 3	$\bar{R}^2$
1974	Williamhouse-Regency	59.01	Republic Texas Corp.	58.51	Cooper Labs	56.21
1975	United Inns	62.26	Oakwood Homes Corp.	49.17	Lehigh Portland Cement	47.15
1976	Pennwalt Corp.	57.92	APL Corp.	54.41	Hoover Company	49.84
1977	Nuclear Dynamics	49.03	Clevepak Corp.	48.78	Shaklee Corp.	42.95
1978	J.W. Mays	43.21	Great Basins Pete Co.	38.02	Medallion Group	37.77
1979	Dorchester Gas	46.72	Foremost-McKesson	46.26	Interface Mechanisms	45.01
1980	National Liberty	55.13	Jack Eckerd Corp.	52.93	Armco Inc.	52.37
1981	Public Service Elec.&Gas	53.57	Minerals Engr. Co	49.44	R.B. Industries	49.11
1982	Tele-Communications Inc.	55.22	Onyx-IMI Inc.	50.80	Rio Grande Drilling	50.80
1983	Texaco	54.01	Andrea Radio Corp.	45.47	Energy Oil	45.18
1984	Vintage Enterprises	50.90	Standard Motor Products	50.05	Wheeling-Pittsburgh Steel	49.02
1985	Ling-Temco-Vought	53.55	Supreme Eq. & Systems	53.50	Knogo Corp.	47.62
1986	ARMEL Inc.	56.17	Numerex Corp.	51.56	Cencor Inc.	51.02
1987	Sunshine-Jr. Stores	83.21	J&J Snack Foods	82.86	KaiserTech	80.67
1988	Great Lakes Chemical	69.77	Helen of Troy Corp.	58.83	Neoax Inc.	55.30
1989	Alpha Microsystems	49.31	Nationwide Cell. Service	48.59	Oakwood Homes Corp.	47.04
1990	Zurn Industries	64.22	Sage Software	62.38	USF&G Corp.	59.17
1991	Magma Copper Co.	56.13	Metcalf & Eddy Comp.	54.00	Methode Electronics	53.14
1992	Brendles Inc.	50.76	Interface	45.57	G-III Apparel Group	45.01
1993	Eateries Inc.	52.18	Genicom	45.69	Piedmont Natural Gas	42.51
1994	Du Pont	62.26	Life Re	61.40	Winnebago Industries	56.83
1995	Methode Electronics	59.72	Bay Ridge Bancorp	53.20	Cascade Natural Gas	48.17
1996	Lincoln National Corp.	52.63	Norwest Corp.	51.95	GTE Corp.	51.28
1997	Textron	55.10	Expeditors Intl.	48.84	Ingersoll Rand	48.74
1998	Metromedia Intl. Group	60.20	Comerica	52.01	Compass Bancshares	50.40
1999	EP Medsystems	44.78	Sanmina Holdings	44.69	KLA-Tencor	42.31
2000	Smartserv Online	61.14	Time Warner Telecom	60.97	Digital Courier Tech.	56.05
2001	A.G. Edwards	68.10	Keithley Instruments	67.22	QLogic Corp.	64.18
2002	FleetBoston Financial	74.06	Kerr-McGee Corp.	70.03	MBNA Corp.	69.75
2003	Principal Fin. Group	62.21	Ambac Fin. Group	60.87	MBIA Inc.	60.27
2004	CentrePoint Energy	58.48	Hillenbrand Inc.	58.18	Massey Energy Co.	52.75
2005	SpectraSite	50.54	Kinder Morgan	45.17	Navistar Intl.	45.06
2006	Oil States Intl.	66.48	Helmerich & Payne	65.53	National Oilwell Varco	64.70
2007	Stillwater Mining	59.76	MeadWestvaco	59.37	Monsanto	57.53
2008	Rowan Companies	81.09	Pride International	75.63	Freeport-McMoRan	74.89
2009	Whiting Petroleum Corp.	75.80	General Cable Corp.	75.19	Atwood Oceanics	74.86
2010	Reliance Steel & Aluminum	75.77	Loews Corp.	75.64	Leucadia National	74.85
2011	Denbury Resources	77.48	Rockwood Holdings	74.44	Stone Energy	73.09
2012	Jones Lang LaSalle	74.83	Ameriprise Financial	71.41	Leucadia National	71.24
2013	Freeport-McMoRan	54.20	Coeur Mining	49.09	Southern Copper	47.57
2014	Arrow Electronics	66.97	Kraft Foods Group	64.41	Tech Data Corp.	61.42
2015	Dana Holding Corp.	61.79	FMC Technologies	59.79	Micron Technology	58.19

This table lists the three firms with the highest integration estimates in each of the 42 years of our sample period. We report our adjusted-R^2 estimates for each of these firms. Firm 1 is the firm with the highest integration estimate for the given year, Firm 2 is the firm with the second highest estimate, and Firm 3 is the firm with the third highest estimate.