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Product market competition, idiosyncratic and systematic volatility

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ABSTRACT

This study finds that competition increases idiosyncratic volatility relative to systematic volatility. Market power facilitates passing on firm specific cost shocks to customers but is irrelevant to passing on market cost shocks. A firm's competitive advantage in an industry is also more affected by changes in firm specific costs when there are many rivals. The results are robust to significant reductions in import tariff rates that reduce market power and consistent with lower pairwise returns' correlations following such events.

1. Introduction

Firms operating in the same industry behave strategically with one another creating inter-firm dependencies in operational decisions (Hao et al., 2011). A firm's risk depends not only on its own financing and investment decisions, but also on its rivals' strategies and actions, as they compete for market share. If a firm's return is driven by market share, then it is affected by the performance of other firms, creating inter-firm stock-returns dependencies. If one firm incurs losses due to firm specific events, then other firms may gain by diverting market shares to them. An increase in competition increases the chances of driving out the firm from its business if firm specific costs get much out of line with those of its competitors. Many studies show the effect the intensity of competition has on firms' return volatility and risk, but its effect on the ratio of idiosyncratic volatility to systematic volatility is unclear.[1]

Market power enables firms to pass on cost increases to consumers through higher prices. Economic theory suggests that this ability is only relevant for reducing the effect of firm specific cost shocks and not industry wide ones. Changes in firm specific costs influences the firm's competitive position in an industry, but this is not the case for changes in industry wide costs. Thus, changes in idiosyncratic risk could be different than those for systematic risk when competition intensity varies.

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[1] See Subrahmanyam and Thomadakis, 1980; Moyer and Chatfield, 1983; Bernier, 1987; Hou and Robinson, 2006; Gaspar and Massa, 2006; and Irvine and Pontiff, 2009.

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We examine the impact of competition on idiosyncratic volatility relative to its impact on systematic volatility, with the expectation that higher competition increase idiosyncratic volatility. A number of studies have investigated the relation between product market competition and firm risk. Gaspar and Massa (2006) show that competition increases firm level idiosyncratic risk and reduces the share in systematic volatility. Irvine and Pontiff (2009) suggest that competition could be related to cross-country differences in idiosyncratic risk and R-square. In contrast, Subrahmanyam and Thomadakis (1980) provide theoretical reasoning that firms with lower (higher) monopoly power exhibit higher (lower) betas or systematic risk. Moyer and Chatfield (1983) and Bernier (1987) find empirical support for the positive effect of competition on systematic risk. The present paper complements and extends this literature by explicitly showing that competition increases the ratio of idiosyncratic risk relative to systematic risk.[2]

We use the Fama–French three-factor model to measure the idiosyncratic and systematic volatility, although our results are the same when we apply the single factor model.[3] Using a sample of firms in the CRSP/COMPUSTAT Merged Database over the 2005-14 period, we find strong empirical support for this expectation. After controlling for a host of variables that the literature shows to have an effect on return volatility, as well as controlling for firm and time fixed effects, our estimates are highly significant.

Initially, we use the Herfindahl–Hirschman index (*HHI*) to measure competition intensity. *HHI* is widely used as proxy for product market competition and is well-grounded in industrial organization theory (see Tirole, 1988). It has also been extensively used in the finance literature, such as in Hoberg et al. (2014) and Giroud and Mueller (2011). Yet, *HHI* is not a perfect measure of product market competition and suffers from various shortcomings. These include ambiguous definitions for industries and an inability to capture collusion between firms, as well as limitations in available data such as the exclusion of private firm data in COMPUSTAT. In recognition of these shortcomings we examine the robustness of our results by using significant reductions in tariff barriers to measure competitive intensity. Using annual 1989-2005 tariff data for U.S. manufacturing we identify industries that experienced an import tariff reduction.[4] Consistent with our main results, the increase in idiosyncratic volatility is significantly larger than the increase in systematic volatility for these industries.

We also use the average pairwise co-movements in returns as a different way to measure the change in systematic volatility relative to the change in idiosyncratic volatility. Return pairwise correlation can be viewed as the proportion of the shared variation between the return of any two stocks to their total return variations. The total return variation is simply the summation of systematic and idiosyncratic volatility. This suggests that if competition induces a greater increase in idiosyncratic volatility, then the return pairwise correlation should decline. When we compare between the average pairwise return correlations before and after the reduction in tariff rates, we find that on average the pairwise correlation falls, in support of our main hypothesis.

Our results are particularly relevant for two reasons. First, they are important for the management of risk following public policy decisions that aim to increase competition, such as industrial deregulation and free trade agreements, as competition increases firm specific relative to systematic risk. While it is true that idiosyncratic volatility may be naively eliminated in well-diversified portfolios, investors may find such diversification unfeasible because of wealth constraints and transaction costs. In addition, Xu and Malkiel (2003) show that idiosyncratic volatility can explain cross sectional differences in returns of individual stocks. Thus, alternatives to portfolio diversification for reducing idiosyncratic volatility in competitive markets can play an important role in lowering risk and the cost of equity.

Second, the results are important for evaluating the effect of competition on the R-square of the single-index model over time and across countries. Campbell et al. (2001) find noticeable increases in firm level volatility relative to market volatility in the United States over the 1962-97 period. Morck et al. (2000) show that R-square is higher in countries with more opaque information environments, relatively low per capita GDP and less developed financial systems. Irvine and Pontiff (2009) argue that information opacity deters a country's product market competition which in turn raises R-square. They claim that the reduced levels of competition and not the information opacity is the driving force behind the high R-square. The present study supports the claim that competition reduces R-square, as it increases firm specific risk more than systematic risk when competition intensity rises.

Our study adds to at least two streams of literature. First, it introduces product market competition as a new variable that can explain why the R-square and other measures of stock market synchronicity are different across markets. Second, it contributes to the stock-return correlations literature by showing how competition is related to the patterns of co-movements in asset returns. The study of co-movements between stock returns is significant in the finance literature, and has recently received much interest especially in international finance as in Bekaert et al. (2009).

The remainder of the paper is structured as follows. Section 2 explains the main hypothesis, and Section 3 the model, variables and sample. Section 4 presents the descriptive statistics and Section 5 the regression results. Section 6 presents evidence on the main hypothesis emanating from trade deregulation, and Section 7 provides the conclusions.

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[2] Menchero et al. (2016) also discuss market (systematic) risk and residual (idiosyncratic) risk in terms of the estimation of beta, and how close the estimated beta is to the true beta. Residual volatility is shown to be minimized when the estimated beta equals the true beta. Nevertheless, they conclude that "…the difference in residual volatility resulting from two distinct beta estimates is likely to be very small". As a result, our estimates of systematic and idiosyncratic volatility are not likely to be affected by errors in the estimation of beta.

[3] We do not, however, use momentum as an additional factor to the Fama-French model, as there is not much support that this factor measures systematic risk. Liew and Vassalou (2000) showed a little support for the relation between WML (winners minus losers) portfolio and the real economy and thus a little evidence to support the risk-based explanation for the WML return factor.

[4] The tariff rate data is available until 2005.

2. Explanations for the main hypothesis

Our main hypothesis is that competition increases idiosyncratic volatility more than systematic volatility. We provide two explanations for this, one based on the operation of a pass through channel and the other on a firm's rank, for different levels of competition.

2.1. Pass through channel explanation

The ability of firms to pass on costs to consumers by increasing prices motivates this explanation. Costs may be classified into those that are firm specific and those that are systematic, that is, industry or market wide. Systematic cost shocks are more easily passed on to consumers by firms regardless of market structure, as all firms in the industry are affected. In contrast, passing on firm specific cost shocks depend on market structure.[5] Firms in concentrated industries can more easily pass on firm specific cost shocks as customers have fewer available substitutes from rivals to escape price increases. This is not the case for firms in highly competitive industries who may lose customers if they increase prices in response to firm specific cost shocks.[6] Firms with monopoly power or in concentrated industries have greater ability to pass on increases in firm specific costs to consumers, whereas less market or monopoly power reduces this ability. It follows that competition raises firm specific risk more than systematic risk.

2.2. Firm's rank based explanation

A firm's competitive advantage may be related to its position relative to its peers in its industry. For example, financing costs may be lower for firms within the highest performance rank in an industry. Jennings et al. (2015) find evidence that investors positively value improvements in the firm's performance ranking within the industry. A firm with a low ranking may also be more easily displaced by potential competitors. The ranking may be driven primarily by changes in firm specific costs rather than industry wide costs. Firm specific cost shocks are more likely to lower a firm's ranking as its costs get out of line with competitors. Industry wide shocks are less likely to affect rankings as these impact all firms in an industry. Competition will more likely magnify the impact of firm specific cost shocks on rankings. At an extreme, firm specific shocks do not affect the ranking of a firm in a monopoly industry as there are no rivals, but will lower the ranking of a firm in a purely competitive industry. On the other hand, industry wide shocks do not affect rankings in either a monopoly industry or a purely competitive industry because in the former there are no rivals and in the latter rivals are also affected by the same shocks.

3. The model, variables and sample

The total volatility of stocks can be decomposed into systematic and idiosyncratic components, with the systematic volatility estimated with a model that incorporates systematic risk factors, and its residuals used to estimate idiosyncratic volatility. We utilize the Fama and French (1993) three factor model for this purpose as shown below.

$$R_{i,t}-R_{f,t}=\alpha_i+\beta_i^{M}\left({R^{M}}_t-R_{f,t}\right)+\beta_i^{SMB}{R^{SMB}}_t+\beta_i^{HML}{R^{HML}}_t+fr_{i,t} \tag{1}$$

where $R_{i,t}$ is the return for firm i, $R_{f,t}$ is the risk-free rate, ${R^M}_t$ is the return to the market portfolio, β_i^M is the beta for the market factor, ${R^{SMB}}_t$ is the difference between the excess return on a portfolio of small versus big capitalization stocks, β_i^{SMB} is the beta for the SMB size factor, ${R^{HML}}_t$ is the difference between the excess return on a portfolio of high-versus low book-to-market stocks, β_i^{HML} is the beta for the HML value factor, and $fr_{i,t}$ is the error term measuring firm specific risk, and the subscript t referencing time t.

In this model, the market factor, small capitalization stocks and high book-to-market (value) stocks are expected to be positively related to the stock's excess returns, such that large stocks and growth stocks (low book-to-market) are associated with lower excess returns.

We use the three-factor model based on Bustamante and Donangelos (2014) finding that product market competition erodes the value of growth options, due to the impact of competitors' investment strategies on the payoff of these options. This causes firms in more competitive industries to have higher book-to-market ratios, making the HML factor relevant in the partitioning of risk. If competition also reduces a firm's size, then it could as well increase the loading on the SMB factor. The results show that this is indeed the case. For these reasons we did not focus our attention on the single-factor model, although the results with only the market factor are basically the same.

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[5] For comprehensive and up-to-date review of the literature on the causes and consequences of differences in cost pass-through and their measurement, see “Cost pass-through: Theory, measurement, and potential policy implications,” A Report prepared for the Office of Fair Trading (RBB Economics, 2014).

[6] Ashenfelter et al. (1998) show that in the limiting case of perfect competition, the firm specific pass through rate goes to zero, indicating that price varies only with industry wide shocks to marginal cost, not with variation in firm specific costs.

The effect of product market competition on idiosyncratic volatility is examined using the following regression,

$$frit = ai + b1\ HHIit + b2\ FLit + b3\ OLit + b4\ TdVit + b5\ MBit + b6\ DPOit + b7\ PMit + b8\ TAit + eit \tag{2}$$

where the dependent variable is the firm-specific risk, that is, the error term fr_{it} in Eq. (1) and *HHI* is the Herfindahl-Hirschman index of concentration. The control variables include *FL* for financial leverage and *OL* for operating leverage, *TdV* for trading volume (in millions) as a proxy for liquidity, *MB* for market-to-book value, *DPO* for dividend payout ratio, *PM* for profit margin, and *TA* for total assets in logarithm as a proxy for firm size. The control variables are measured on an annual basis.

HHI measures product market competition, with different specifications based on two, three and four-digit Standard Industrial Classifications (SIC). An inter-temporal increase in the value of *HHI* indicates a decrease in competition.[7] The measurement and justification for the controls variables are the following. Financial leverage (*FL*), measured as the quotient of total liabilities to total assets, is shown by Hamada (1972) to increase the stock's systematic risk. Operating leverage (*OL*), measured as the ratio of net property, plant and equipment to total assets, is shown by Lev (1974), using Hamada's (1972) approach, to also increase the stock's systematic risk. Mandelker and Rhee (1984) also demonstrate how financial and operating leverage contribute to the systematic risk of common stocks. Trading volume (*TdV*), measured by number of shares traded divided by total shares outstanding (in millions), is a proxy for liquidity, and accounts for the positive association between return volatility and volume. When stock prices react to information continuously, returns will change more rapidly causing higher return volatility. Karpoff (1987) cites many studies that show a positive relation between price volatility and trading volume in a variety of financial markets including the equity market. Market-to-book (*MB*) is measured by the ratio of market value of total assets [total assets minus book equity plus market value of common stocks, with the latter equal to the product of common shares outstanding and the closing price (*P*) at the end of fiscal year] to the book value of total assets. It has two opposing effects on risk. First, high MBs may reflect the extent of the firm's market power and monopoly rents, and relate negatively to systematic and idiosyncratic risk. Second, firms with high MBs may have many growth opportunities whose values are mainly derived from future investments, with values less predictable than for low-growth firms whose values are derived mainly from current investments. In this case, high MBs may increase return uncertainty and, therefore, risk. Dividend payout ratio (*DPO*), measured as the ratio of common dividends divided by income before extraordinary items, can also proxy for risk. Hoberg and Prabhala (2009) report that risk is a significant determinant of the propensity to pay dividends, as it explains roughly 40% of the phenomenon of disappearing dividends between 1978 and 1999. Dividends are negatively related with risk because firms that operate under high uncertainty would prefer to accumulate retained earnings by reducing dividends. Grullon et al. (2002) and Julio and Ikenberry (2004) find that firms increase dividends when they become more mature and less risky. Bergeron (2012) finds that the dividend payout ratio of a stock is negatively related to its long-run risk, defined as the covariance between dividends and consumption. Recently, Varela (2015) shows that firms that pay high dividends have lower risk owing to lower durations for their stocks. Profit margin (*PM*), measured as the ratio of earnings before interest and taxes divided by sales, is hypothesized by Logue and Merville (1972) to represent higher operating efficiency, resulting in a lower probability of distress and risk. Gaspar and Massa (2006) argue that firms with higher profits are less proportionately affected by a given size shock, as absolute changes will have smaller impacts on the percentage changes in profit when the level of profit is high. Total assets (*TA*) is a proxy for size measured as the logarithm of total assets. Large firms tend to have low systematic risk because of their ability to diversify assets into different business segments. Amihud and Lev (1981) suggest that diversification is associated with lower firm risk due to existence of multiple lines of business with imperfectly correlated returns. Large firms may also possess a level of market power which could enable them to reduce cost shocks as mentioned in Moyer and Chatfield (1983).

The sample is from the CRSP-COMPUSTAT merged universe of stocks for the 2005–14 period with observations on a monthly basis, excluding financial (SIC 6000-6999) and utility firms (SIC 4900-4999). We run, as in Gaspar and Massa (2006), time-series regressions for each stock in the sample using 36-monthly returns starting with the most recent observations and then rolling back the regressions. The square of the monthly residuals obtained from the three factor time series regressions in Eq. (1) is used to calculate idiosyncratic return volatility in month t, where t corresponds to the last month of the 36 monthly returns in a regression. We use monthly instead of daily returns in line with most studies in this area [for example, Fama and Macbeth (1973)]. We follow Fu (2009) in requiring a minimum of 15 monthly returns during any 36 monthly returns time period to reduce the impact of infrequent trading on our estimates of monthly idiosyncratic volatility and beta. Systematic risk is measured as the difference between the variance of the returns and idiosyncratic volatility. The yearly beta and yearly idiosyncratic volatility for firm i are obtained by taking the average of the 12-monthly beta and idiosyncratic volatility estimate in a given year during the sample. The final sample consists of 30,234 firm-year observations.

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[7] The Herfindahl-Hirschman index (*HHI*) equals the sum of the squared market shares of all firms in an industry, such that:

$$HHI = \sum_{i=1}^{N} S_i^2$$

where N is the number of firms in an industry and S_i is the market share of firm *i* in that industry. *HHI* ranges from 0 to 1 with the former representing a large number of very small firms and the latter a single firm.

Table 1
Descriptive statistics for the factors and variables in the sample.

	N	Mean	Standard deviation	Q1	Median	Q3
Panel A – factors						
β_i^M	33,528	1.23003	0.98158	0.68477	1.149858	1.6898
β_i^{HML}	20,477	0.09909	1.49902	−0.6306	0.108485	0.8459
β_i^{SMB}	20,477	0.83898	1.43588	0.008746	0.696199	1.52881
ISV	33,528	0.02423	0.06372	0.006112	0.012745	0.026125
SV	33,528	0.00476	0.00788	0.000869	0.002571	0.005954
R-sq	33,528	0.20677	0.17031	0.071465	0.182674	0.31894
Panel B – variables						
HHI	33,527	0.26817	0.20934	0.12319	0.1960463	0.348243
FL	33,411	0.50286	0.54831	0.29603	0.4744461	0.638436
OL	33,499	0.25625	0.24269	0.067718	0.1663132	0.379079
TdV	33,483	2.09021	2.32110	0.066821	1.49698	2.73437
MB	33,385	2.00271	2.57114	1.0903	1.4863	2.2196
DPO	33,391	0.25569	6.23585	0.00000	0.00000	0.16771
PM	32,840	−6.19098	229.0339	−0.0025098	0.0673831	0.141764
Ln TAs	33,511	6.353329	2.17635	2.91	6.31	7.81

Note: β_i^M is the beta for the market factor, β_i^{SM} is the beta for the SMB size factor, and β_i^{HML} is the beta for the HML value factor. Idiosyncratic volatility is the sum of the monthly squared residuals with respect to the Fama-French three-factor model in Eq. (1). Systematic volatility (SV) is the difference between total volatility and idiosyncratic volatility (ISV). *R-sq* is the percentage of a security's return variability that can be explained by the Fama-French three-factors. HHI is the Herfindahl-Hirschman index, FL is financial leverage measured as total liabilities divided by total assets, OL is operating leverage measured as net property, plant and equipment divided by total assets, TdV is trading volume (in millions) as a proxy for liquidity measured as the number of shares traded divided by total shares outstanding, MB is market-to-bookmeasured as market value of total assets divided by book value of total assets, DPO is dividend payout ratio measured as common dividends divided by income before extraordinary items, PM is profit margin measured as earnings before interest and taxes divided by sales, and TA is total assets as a proxy for firm size measured as the logarithm of total assets.

4. Descriptive statistics

Table 1 presents descriptive statistics for the factors (Panel A) and variables (Panel B) in the sample. Regarding the factors, the value of 1.23 for the average beta (market factor) is higher than the 0.96 estimated by Harvey (1991) for the U.S. market for the period 1970-89. The average loading on the HML factor is 0.099 and on SMB is 0.8389. Fama and French (1993) suggest that these three factors reflect common risk factors, such that we estimate systematic volatility as that explained by these Fama-French factors.

The part of the stock's return volatility due to idiosyncratic risk is much greater than that due to systematic risk. The mean (median) idiosyncratic volatility (*ISV*) is 0.0242 (0.0127) and systematic volatility (*SV*) is 0.00476 (0.00257). French and Roll (1986) and Roll (1988) conclude that most of the variation in U.S. stock prices reflects the capitalization of firm specific events. Van Horne (1998) showed that unsystematic risk accounts for approximately 75% of the total risk, or variance, of the average stock in the United States.[8] The ratio of unsystematic volatility to total volatility in our sample is 79.3%. The mean (median) share of systematic volatility, as indicated by R-square, is around 20.67% (18.27%).

The results for HHI, our most critical variable, show a mean value of 0.268 which is higher than reported by Gaspar and Massa (2006). The median value of 0.196 suggests that the distribution of HHI is skewed to the left.

The sample is divided into two groups in Table 2 based on the median for *HHI*. The first (second) group comprises firms operating in highly (lowly) competitive industries, defined as those with *HHI*s lower (higher) than the median. Descriptive statistics for these two groups are shown along with the results of parametric *t*-tests and nonparametric Wilcoxon signed-rank tests for mean and median differences, respectively.

Firms in highly competitive industries have a mean (median) idiosyncratic volatility of 0.0267 (0.014), whereas firms in lowly competitive industries have a mean (median) of 0.0216 (0.0115). Idiosyncratic volatility is higher for firms in highly competitive industries. The mean (median) differences between the two groups are significant at the 1% level. In contrast, there is no significant mean difference in systematic volatility, and only 10% level significantly higher median difference for competitive industries.

All three-factor loadings are positive, but the β_i^M and β_i^{SMB} loadings are higher and the β_i^{HML} is lower in the highly competitive compared to the lowly competitive industries, with the differences significant at the 1% level in both the mean and median. This result suggests that firms in highly competitive industries are more sensitive to the market and size factors, but less sensitive to the book-to-market factor, than firms in lowly competitive industries. The latter is consistent with Bustamante and Donangelo (2014) who find that firms in highly competitive industries generate value from assets in place, as

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[8] Unsystematic risk, firm specific risk and idiosyncratic volatility are used interchangeably in this paper.

Table 2
Descriptive statistics and significance for factors, volatility measures, and variables in highly and lowly competitive industries.

	Firms in highly competitive industries				Firms in lowly competitive industries				Mean difference	Median difference
	N	Mean	Median	Standard deviation	N	Mean	Median	Standard deviation		
Panel A – factors and volatility										
β_i^M	16,763	1.25313	1.1683	1.01143	16,765	1.20694	1.128464	0.950258	0.0462***	0.03984***
β_i^{HML}	10,514	0.03338	0.0379	1.58903	9963	0.16841	0.168527	1.394477	−0.1350***	−0.13063***
β_i^{SMB}	10,514	0.867	0.72408	1.5055	9963	0.809	0.669767	1.35792	0.0584***	0.05431***
ISV	16,763	0.02677	0.014	0.07953	16,765	0.02168	0.011526	0.042209	0.00509***	0.00247***
SV	16,763	0.00478	0.0026	0.00804	16,765	0.00474	0.00254	0.00772	0.00004	0.00005*
SV/ISV	16,763	0.31934	0.21186	0.36798	16,765	0.37151	0.243571	0.430251	−0.0522***	−0.03171***
R-square	16,763	0.19669	0.17312	0.1641	16,765	0.21685	0.193025	7.234543	−0.0202***	−0.01991***
Panel B - variables										
HHI	16,762	0.12363	0.12319	0.04249	16,765	0.41267	0.34824	0.209907	−0.2890***	−0.22505***
FL	16,688	0.50148	0.4606	0.53926	16,723	0.50423	0.485314	0.557204	−0.0027***	−0.024714***
OL	16,744	0.28353	0.16913	0.27334	16,755	0.22898	0.164414	0.203999	0.0545***	0.004716***
TdV (million)	16,738	2.20858	1.57162	2.33163	16,745	1.97189	1.42846	2.304528	0.2367***	0.14316***
MB	16,670	2.18489	1.5724	2.50483	16,715	1.82101	1.41374	2.62311	0.3639***	0.15866***
DPO	16,697	0.2345	0	5.04349	16,694	0.27689	0	7.23454	−0.0424	0
PM	16,215	−11.5713	0.0715	324.123	16,625	−0.9433	0.06519	33.20083	−10.628***	0.00631*
Ln TAs	16,755	6.34852	6.2522	2.23885	16,756	6.35813	6.35576	2.112059	−0.0096	−0.10356**

Note: Firms in highly (lowly) competitive industries are defined as those with HHIs lower (higher) than the median. The *t*-test results are for mean differences and nonparametric Wilcoxon signed-rank test results for median differences. The symbols ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 levels, respectively. See note to Table 1 for acronym identifications.

their discount rates are lower, whereas those in lowly competitive industries generate value from the growth options of yet-to-be-made investments.

The idiosyncratic compared to the systematic volatility is higher in highly competitive industries, that is, the systematic/unsystematic ratio is less in highly compared to lowly competitive industries, with the differences significant at the 1% level in both the mean and median. Thus, the R-square, which reflects the percent of the variance explained by common risk factors, is significantly lower at the 1% level in the competitive industries both for the mean and median.

The Pearson correlation coefficients, most of which are statistically significant, are reported in Table 3. Most notably, *HHI*, which inversely relates to competition intensity, is significantly (at the 1% level) negatively correlated with the idiosyncratic volatility (−0.075) and β_i^M (−0.29), such that competition is positively correlated with idiosyncratic volatility and a lower coefficient of systematic risk. The highest correlation is between R-square and systematic volatility reflecting the mechanical relation where the former reflects the percent of return volatility that is explained by the three-factor model. Correlations are the most negative between β_i^{SMB} and β_i^M (−0.35), idiosyncratic and systematic volatility (−0.301), and β_i^{SMB} and *TA* (−0.263), all significant at the 1% level. Note that idiosyncratic and systematic volatility and *TA* are in natural logs. Generally, there is no serious multicollinearity problem between the independent variables.

5. Regression results

Table 4 presents results for regressions of idiosyncratic volatility (Model 1), systematic volatility (Model 2) and R-square (Model 3) on product market competition (measured by *HHI*), and the control variables previously mentioned. The risk variables are in logs to address concerns that large kurtosis and skewness of variance measures might affect the distribution of the standard errors and statistical inferences (Goyal and Santa-Clara, 2003). Firm and year dummies are included in all specifications.

The impact of competition (*HHI*) on idiosyncratic volatility (Model 1) is positive and statistically significant, as the coefficient for *HHI* is significantly negative (−0.16214) at the 1% level, implying that higher competition (lower *HHI*) increases idiosyncratic risk. The impact of competition on systematic volatility (Model 2), in contrast, is not significant, implying that competition mainly increases firm-specific risk. These results in combination suggest that the proportion of idiosyncratic to total volatility increases the higher the level of competition, and that R-square is lower in factor models the more intense the competition. Indeed, the impact of competition (*HHI*) on R-square (Model 3) is significantly negative, as the coefficient for *HHI* is significantly positive (0.05949) at the 1% level. The results concerning the control variables match roughly those of the prior literature.[9]

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[9] Trading volume (*TdV*) is significantly positively associated with both systematic and idiosyncratic volatility at the 1% level, as higher volume speeds the information flow that increases volatility. Firm size (*TA*) is significantly negatively related to both systematic and idiosyncratic volatility at the 1% level. Financial leverage (*FL*) is significantly positively related to systematic at the 10% level and idiosyncratic volatility at the 1% level, and operating leverage (*OL*) is significantly positively related to systematic volatility at the 1% level.

Table 3

Pearson correlation coefficients among the factors and variables used in OLS regressions (1) and (2), and the measurements of idiosyncratic volatility (*ISV*) and systematic volatility (*SV*).

Variables	*ISV*	*SV*	*R-sq*	β_i^{M}	β_i^{HML}	β_i^{SMB}	*FL*	*OL*	*TdV*	*MB*	*DPO*	*PM*	*TA*	*HHI*
ISV	1													
SV	−0.301***	1												
R-sq	0.489***	0.666***	1											
β_i^{M}	0.364***	0.318***	0.588***	1										
β_i^{HML}	−0.045***	−0.007	−0.045***	0.058***	1									
β_i^{SMB}	0.351***	0.089***	0.358***	−0.35***	0.015*	1								
FL	0.017***	0.012**	0.03***	0.051***	0.039***	−0.023***	1							
OL	−0.068***	0.055***	−0.003	0.008	0.169***	−0.069***	0.082***	1						
TdV	0.098***	0.130***	0.198***	0.123***	−0.08***	0.135***	0.021***	−0.043***	1					
MB	0.069***	−0.073***	−0.019***	−0.028***	−0.092***	0.042***	0.255***	−0.123***	0.064***	1				
DPO	−0.025***	0.017***	−0.003	−0.008	−0.0002	−0.003	0.0007	0.011*	−0.013**	−0.004	1			
PM	−0.033***	0.025***	−0.003	0.0145**	0.018**	−0.030***	−0.009	0.002	−0.002	−0.042***	0.001	1		
TA	−0.587***	0.371***	−0.098***	−0.038***	0.048***	−0.263***	0.117***	0.242***	0.135***	−0.149***	0.013**	0.027***	1	
HHI	−0.075***	0.022***	−0.031***	−0.029***	0.051***	−0.0106	−0.018***	−0.114***	−0.044***	−0.061***	0.011*	0.016***	−0.031***	1

Note: For the calculation of correlation coefficients, ISV, SV, TdV and TA are in ln. The symbols ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 levels, respectively. See note to Table 1 for acronym identifications.

Table 4
Results for regressions of idiosyncratic volatility, systematic volatility and R-square on product market competition.

	Model (1) Idiosyncratic volatility	Model (2) Systematic volatility	Model (3) R-square
HHI	−0.16214***	0.08513	0.05949***
	(0.0609)	(0.10656)	(0.01485)
β_i^M	0.20167***		0.072008***
	(0.00505)		(0.001242)
β_i^{HML}	−0.01431***		−0.00852***
	(0.003226)		(0.000797)
β_i^{SMB}	0.13995***		0.04227***
	(0.00393)		(0.00097)
FL	0.12161***	0.05771*	−0.004821
	(0.01654)	(0.03043)	(0.00401)
OL	−0.10141	0.24237**	0.015229
	(0.06228)	(0.10305)	(0.015401)
TdV (million)	0.21789***	0.20023***	−0.03689***
	(0.00696)	(0.01120)	(0.00166)
MB	−0.0095***	−0.00737**	0.002145***
	(0.00193)	(0.00358)	(0.00046)
DPO	−0.000081	0.00131	0.0000845
	(0.00060)	(0.000849)	(0.000150)
PM	−0.0000704***	−0.000016	0.000014**
	(0.000021)	(0.00003)	(0.000006)
TA	−0.25064***	−0.117428***	0.056137***
	(0.00919)	(0.01604)	(0.002037)
Firm dummies	YES	YES	YES
Year dummies	YES	YES	YES
Observations	17,552	29,485	17,552
Adjusted R square	0.1516	0.4602	0.4602

Note: Model (1) uses idiosyncratic volatility (ISV), model (2) systematic volatility (SV) and model (3) R-square (R-sq) as dependent variables, with product market competition measured by the Herfindahl-Hirschman index of concentration (HHI). For these regressions, ISV, SV, and TA are in ln. The symbols ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 levels, respectively. The standard errors are clustered at the firm level. See note to Table 1 for acronym identifications.

Our results raise the question as to why does competition not increase systematic risk. The answer lies in the components of systematic risk in the three-factor model, and how they are affected by changes in the level of competition. Table 5 presents the results of the effect of competition on the Fama-French three factor model betas.

Table 5
Results for regressions of β_i^M, β_i^{HML}, and β_i^{SMB} on product market competition.

	Model (1) β_i^M, CAPM Beta	Model (2) β_i^{HML}, HML Beta	Model (3) β_i^{SMB}, SMB Beta
HHI	−0.022417	0.89685***	0.50141***
	(0.08719)	(0.1689)	(0.15813)
FL	0.117527***	0.17656***	−0.05898
	(0.02490)	(0.04589)	(0.04296)
OL	0.056779	−0.13398	0.29134*
	(0.08432)	(0.17297)	(0.16194)
TdV (million)	0.134385***	−0.119655***	0.07615***
	(0.009165)	(0.0191)	(0.01789)
MB	−0.007782***	−0.014565**	−0.002924
	(0.00293)	(0.00536)	(0.00502)
DPO	−0.000126	−0.000169	0.000949
	(0.00060)	(0.00168)	(0.00158)
PM	0.0000598**	0.000131**	−0.000098*
	(0.000024)	(0.00006)	(0.000056)
TA	−0.097122***	−0.196997***	−0.000098
	(0.01312)	(0.02548)	(0.02386)
Firm dummies	YES	YES	YES
Year dummies	YES	YES	YES
Observations	29,485	17,552	17,552
Adjusted R square	0.579	0.525	0.508

Note: Model (1) uses risk factor β_i^M, model (2) β_i^{HML} and model (3) β_i^{SMB} as dependent variables, with product market competition measured by the Herfindahl-Hirschman index of concentration (HHI). For these regressions, TA is in ln. The symbols ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 levels, respectively. The standard errors are clustered at the firm level. See note to Table 1 for acronym identifications.

Table 5 shows that competition (*HHI*) significantly reduces the value factor beta β_i^{HML} (0.89685, 1% level) and size factor beta β_i^{SMB} (0.50141, 1% level), but has no effect on the market factor beta β_i^{M}. These results imply that competition in sum reduces systematic risk because of its effects on value and size. In the CAPM the systematic measure of risk is β_i^{M} such that in this case competition does not significantly increase systematic risk, as the coefficient of *HHI* in Model (1) is not significant. But by considering the other factors in the Fama-French model, competition lowers the HML and SMB factors, which in turn reduces systematic risk.[10]

6. Evidence on the main hypothesis emanating from trade deregulation

6.1. Univariate analysis of tariff reductions on systematic and idiosyncratic volatility

This section presents results on the impact of the softening of trade barriers on systematic and idiosyncratic volatility. Bernard et al. (2006) show that the reduction of U.S. import tariff rates increases the competitive pressure that U.S. firms face from foreign rivals. The data, following Frésard and Valta (2013), includes the annual tariff for the U.S manufacturing sector (available on Peter Schott's (2015) website).[11] The annual tariff is computed as duties collected at U.S. customs divided by the Free-On-Board customs value of imports at the four-digit SIC industry level.

Fig. 1 shows that the number of industries in the sample based on four-digit SIC codes are not concentrated with respect to time, although the highest frequency of industries in the sample occurred in the 1995-97 period. The results should be independent of time-specific effects on the number of industries in the sample.

Fig. 2 shows U.S. average annual tariff rate reductions during the 1990-2005 sample period. The biggest tariff reduction occurred in 1990 (coinciding with the 1989 U.S.-Canada Free Trade Agreement), although other tariff reductions occurred in 1993 (coinciding with the 1993 ratification of NAFTA in the U.S.), as well as in 1998, 1999 and 2005, among others.

Table 6 shows that the reduction of import tariff rates in the U.S. significantly increased the idiosyncratic and systematic volatility. The average growth rates for idiosyncratic (*ISV*) and systematic volatility (*SV*) are calculated during the year preceding the tariff reduction ($t-1$) and during the year that follows the tariff reduction ($t+1$). As observed, the mean (median) idiosyncratic volatility increased by 0.00223 (0.00118) and systematic volatility by 0.0006922 (0.000108), as shown in the last two lines of the table. The *t*-tests for means and Wilcoxson signed rank tests for medians are significant for both volatilities at the 1% level. The mean (median) increase in idiosyncratic and systematic volatility is 0.00154 (0.001075), with competition increasing firm-level volatility more than systematic volatility.

6.2. Multivariate analysis of tariff reductions on systematic and idiosyncratic volatility

This section compares idiosyncratic and systematic volatility before and after reductions in tariff rates using a multivariate analysis. The reduction in tariff rates is an exogenous change in product market structure producing lower barriers to entry and more competition. The focus is on firms that experienced a significant tariff reduction that is at least three times larger than the average industry tariff reduction, following the approach used by Frésard and Valta (2013).

The significance of tariff rate reductions on idiosyncratic (*ISV*) and systematic (*SV*) volatility is estimated with the following regression,

$$\Delta Y_{\mathrm{i,j,t}} = \partial\left(Post{-}reduction_{\mathrm{j,t}}\right) + \text{Ꝑ}\Delta X_{i,\mathrm{t}-1} + e_{\mathrm{i\ j,t}} \tag{3}$$

where the dependent variable $\Delta Y_{\mathrm{i,j,t}}$ is either the change in systematic volatility (Δ *SV*) or idiosyncratic volatility (Δ *ISV*) for firm i, *Post-reduction* $_{\mathrm{j,t}}$ is a dummy variable equal to 1 when industry j experiences a tariff rate reduction that is at least three times larger than the average tariff rate reduction in that industry, and subscripts i, j, and t represent the firm, industry, and year of the significant tariff rate reduction, respectively. The vector $X_{i,\ t\ -\ 1}$ includes the control variables previously used.

The estimate of the tariff reduction shock's effect on volatility is ∂, the coefficient of *Post-reduction* $_{\mathrm{j,t}}$. The expectation is that ∂ is positive, such that as the intensity of competition increases because of significantly lower import tariff rates, that the volatility also increases. We also expect that the increase in *ISV* should be higher than the increase in *SV*, if the results are to be consistent with our prior arguments.

A concern in the analysis is that firms may adjust their investment and financial policy when anticipating lower import tariff rates and thus influence volatility. Frésard and Valta (2013) find that following tariff rate reductions firms substantially reduce debt issuance and reduce capital, research and development, and acquisition expenditures. These adjustments suggest that firms balance the increase in risk from competitive pressures by reducing investment and financial risk, with immediate effects

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[10] Although HML and SMB factors may be viewed as related to stock return anomalies, a number of authors consider them as common risk factors. Berk (1995) argues that relative firm size measures risk and not a pricing anomaly, based on the intuition that if firms have the same size and cash flow, then risker firms could have lower market values and higher expected returns. As such, the *SMB* factor, which mimics a portfolio for the returns on small minus big stocks, can be regarded as a risk factor. Liew and Vassalou (2000) find that HML and SMB contain significant information about future GDP growth. In particular, they show that the predictive power of HML and SMB is not subsumed when the market factor or business cycle variables are included in a regression that predicts returns.

[11] The tariff data are available on Peter Schott's website, referenced as: http://www.som.yale.edu/faculty/pks4/sub_international.htm.

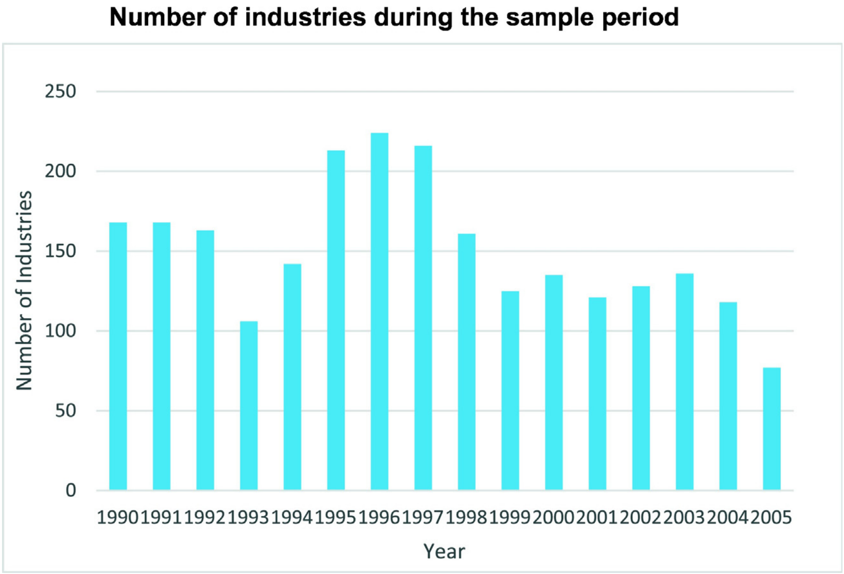

Fig. 1. This figure shows the number of industries in each year in the sample period. The industries include manufacturing industries defined using the four-digit SIC code.

on their return volatility. We account for this possibility by employing first differences in variables rather than their levels, thereby controlling for the effects of changes in investment and financing that accompany changes in tariffs.

Table 7 presents the estimation results for Eq. (3). The coefficients of *Post-reduction* $_{j,t}$ are 0.00612 (significant at 5% level) for the Δ *ISV* (Model 1) and 0.00349 (significant at 1% level) for the Δ *SV* (Model 2). The increase in *ISV* is greater than in *SV* by an amount equal to 0.00263 (that is, 0.00612–0.00349) following a competitive tariff shock, with the z-score for this difference significant at the 1% level (not shown in the table). This result supports our main hypothesis that increases in competition intensity are more strongly associated with increases in *ISV*. Our results also suggest an increase in the uncorrelated return variation in stock returns (*ISV*) as competition increases, that is, decreases in the co-movements of stock returns. This implication is tested in the next section.

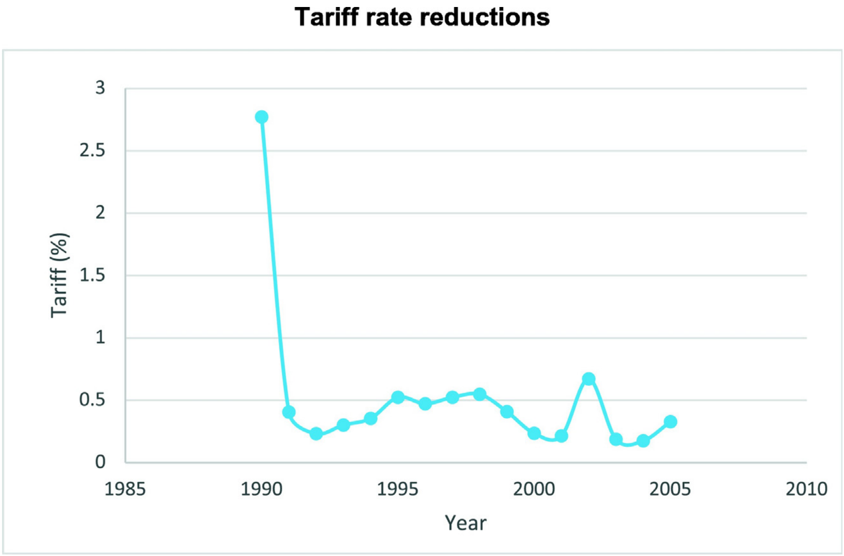

Fig. 2. This figure shows the average tariff rate reduction in each year of the sample which spans from 1990 to 2005. The annual tariff is computed as duties collected at U.S. Custom divided by the Free-On-Board custom value of imports at the four-digit SIC industry. Tariff (%) is the percentage decline in tariff rate.

Table 6
Descriptive statistics for changes in volatility around tariff rate reductions.
This table presents the mean and median of the average growth rates for idiosyncratic (*ISV*) and systematic (*SV*) volatility for the sample of firms that experienced a significant tariff reduction between 1990 and 2005.

Volatility and observations		Mean	*t*-Test (*p*-value)	Median	Wilcoxson signed rank (*p*-value)
Idiosyncratic volatility$_{(t-1)}$	4,930	0.02017247	<0.0001	0.009382	<0.0001
Idiosyncratic volatility$_{(t+1)}$	4,926	0.02027487	<0.0001	0.009431	<0.0001
Systematic volatility$_{(t-1)}$	4,773	0.00310094	<0.0001	0.00136	<0.0001
Systematic volatility$_{(t+1)}$	4,751	0.00304795	<0.0001	0.00135	<0.0001
Diff Idiosyncratic volatility	1,647	0.00223417	<0.0001	0.001183	<0.0001
Diff Systematic volatility	1,575	0.0006922	0.0090	0.000108	0.0022

Note: The average growth rate is calculated for idiosyncratic (*ISV*) and systematic volatility (*SV*) during the year preceding the tariff reduction ($t-1$) and during the year that follows the tariff reduction ($t+1$). The *ISV* for a firm is computed by estimating the mean square residuals from the three-factor model using monthly returns for the past 36 months, and the *SV* is measured as the difference between the total volatility and idiosyncratic volatility. Also, *p*-values for test statistics are shown for mean differences from zero (standard *t*-test) and median differences from zero (Wilcoxon signed-rank test) for the first four rows, and for differences in means (standard *t*-test) and medians (Wilcoxon signed-rank test) in the last two rows.

6.3. Evidence of tariff reductions on volatility

6.3.1. Evidence from pair-wise returns correlations

Literature suggests that return correlations can be used to infer the ratio of idiosyncratic (*ISV*) to systematic (*SV*) volatility. A high correlation is consistent with common risk factors driving stock returns, and a low correlation with firm-specific risk factors. Campbell et al. (2001) found, using CRSP 1962-97 daily returns, noticeable increases in firm-level volatility with decreases in correlations among individual stocks and in the explanatory power of the market model. We therefore infer support for the argument that the effect of competition on idiosyncratic volatility is larger than its effect on systematic volatility if competition, such as that triggered by the reduction in import tariff rates, reduces average pair-wise correlations.

Table 7
Regressions for changes in volatility around tariff rate reductions.
This table presents coefficient estimates of the effect of tariff rate reductions on volatility measures between 1990 and 2005. The dependent variable is the change in idiosyncratic volatility (*ISV*) for Model (1) or the change in systematic volatility (*SV*) for Model (2). *Post-reduction* $_{j,t}$ equals one if industry j has experienced a tariff rate reduction by time t that is larger than three times the mean tariff rate reduction in that industry. Δ*ISV* and Δ*SV* is the difference in idiosyncratic and systematic volatility before and after the reduction of tariff rates. *ISV* for a particular firm is computed by estimating the mean square residuals from the three-factor model using monthly returns for the past 36 months. *SV* is measured as the difference between the total volatility and idiosyncratic volatility. All control variables are measured as the change in their values during the year of tariff reduction.

	Model (1) Δ *ISV*	Model (2) Δ *SV*
Intercept	−0.01594***	−0.00894***
	(0.00152)	(0.00087258)
Post-reduction $_{j,t}$	0.00612**	0.00349***
	(0.00247)	(0.00110)
Δ*FL*	0.00396	−0.00299
	(0.00942)	(0.00539)
Δ*PM*	−0.00073118***	−0.00017991
	(0.00021507)	(0.00021711)
Δ *TA* (in ln)	−0.00668***	−0.00076114
	(0.00223)	(0.00196)
Δ *OL*	−0.05143**	−0.01934***
	(0.01996)	(0.00677)
Δ *P*	−0.00003245	−0.00002665**
	(0.00002033)	(0.00001330)
Δ *TdV*	0.01056***	0.00430***
	(0.00212)	(0.00089000)
Δ *MB*	−0.00043527	0.0008554
	(0.00134)	(0.00076172)
Δ *DPO*	0.00001763	0.00005035*
	(0.00003117)	(0.00002870)
Adjusted R-sq	0.0962	0.0543
Observations	698	698
Z-Statistics (∂1-∂2)		25.69
p-Value		<0.01

Note: See note to Table 1 for acronym identifications. In addition, *ISV* is idiosyncratic volatility, *SD* is systematic volatility, and *P* is the closing price. Standard errors are shown in parenthesis and the symbols ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

Table 8

Pair-wise correlation before and after reduction in import tariff rates, 1989-2005.

This table presents mean and median pairwise correlation of stock returns before and after the year that significant reductions in import tariff rates occurred, defined as negative change in tariffs that is three times larger than the industry's average negative change.

	N	Mean	*t*-Test (*p*-value)	Median	Signrank (*p*-value)
Return correlation (t − 1)	12,028	0.2066	<0.0001	0.19667	<0.0001
Return correlation (t + 1)	12,028	0.19867	<0.0001	0.19625	<0.0001
Diff return correlation ([t + 1] − [t − 1])	12,028	−0.0079	0.0016	−0.0091	0.001
Diff of positive return correlation ([t + 1] − [t − 1])	8,054	−0.0077	0.0017	−0.0067	0.0024

Note: Return correlation (t − 1) [return correlation (t + 1)] is the average return pairwise correlation before [after] event time (t) corresponding to the year of a significant reduction in tariff rates. Diff return correlation ([t + 1] − [t − 1]) is the change in pair-wise correlation after the significant reduction in import tariff rates. Diff of positive return correlation ([t + 1] − [t − 1]) considers changes only in positive valued pair-wise correlations after the reduction in tariff rates. The *p*-values are associated with test statistics for differences in means for the standard *t*-test and in medians for the Wilcoxon signed-rank test.

We compare pair-wise correlations before and after import tariff rate reductions that are three times larger than the industry's average using the sample as in the analysis above. Pearson correlation coefficients are calculated between the return distributions for stock i and all other stocks. We use monthly return data within the past three years and require firms to have at least 15 monthly stock returns observations. Table 8, row 3, shows mean return pairwise correlation decreases after a tariff reduction of 0.0079, equivalent to a 3.82% decrease in correlation [equal to $(0.0079 / 0.2066) * 100$], whereas the median return pairwise correlation decreases by 0.0091, equivalent to a 4.62% decrease [equal to $(0.0091 / 0.19667) * 100$]. The mean and median decreases are both significant at the 1% level. Also, when we only consider the pairwise correlations that are positive before and after the reduction in tariff rates, we also notice as shown in Table 8, row 4 a reduction in the mean and median correlations. These findings suggest that the increase in competition from reduced tariffs increases idiosyncratic volatility compared to systematic volatility. Stock returns are less correlated as idiosyncratic volatility comprises a larger portion of the total return volatility.

6.3.2. Evidence from regressions on pair-wise returns correlations

A regression of the average pair-wise returns correlations between stocks on a reduction in tariff rates supports these results. The correlations are regressed against the Post-reduction dummy variable which equals 1 if the reduction in tariff rates is larger than three times the average reduction in its industry. The regression also controls for other factors that are possible determinants of the returns correlations, as in Chen et al. (2009). These other factors are: Sales growth, Size (Equity), Book-to-Market, Same State, Firm Age, Exchange Listing, S&P Index, Price Difference, Financial Leverage and Industry.

Sales growth is the absolute value of differences in log growth rates between two firms, with correlations expected to be higher for firms with similar growth rates. Size, a Fama-French factor, is the log of the market value of equity. Barberis and Shleifer (2003) suggest that investors classify securities into styles by grouping those with common characteristic such as size, with news about a particular firm possibly affecting the price movements of others in the same category. Book-to-market, a Fama-French factor, is the absolute value difference in the log of book-to-market ratios for any pair of firms, and may be viewed as defining firms with the same style the more similar their ratios. Boyer (2011) finds that stocks that just switched from a growth to a value index co-move significantly more. Same State, a proxy for geographic location, is a dummy variable equal to 1 if two firms are headquartered in the same state and 0 otherwise. Pirinsky and Wang (2006) show strong co-movement in the stock returns of firms headquartered in the same geographic area. Firm Age, the absolute value difference between the logs of ages of any pair of firms, is a proxy for how close firms are to each other in their life cycle. The age for any firm is equal to one plus the difference between the current year and the first year that the firm appears in the CRSP database. Exchange Listing is a dummy variable equal to 1 if two stocks are listed on the same stock exchange and 0 otherwise, as price movements could be caused by the market structure of the stock exchange where the stocks are traded. S&P Index is a dummy variable equal to 1 if two firms belong to the same S&P Industry or Economic Sector code, and 0 otherwise, as two stocks belonging to the same S&P index could experience greater co-movement in returns than otherwise. Price Difference, the absolute difference in the log price between two firms in any pair at the end of a given year, is related to Green and Hwang (2009) who provide evidence that investors categorize stocks based on price. Financial leverage, the absolute value difference in two firms' financial leverage ratios, could amplify the relation between economic conditions and firm returns. Industry is a dummy variable for a stock pair if they are in the same 4-digit SIC industry, as such firms may face similar economic factors.

Table 9 reports results for Model 1 in which the dependent variable is the absolute correlation and Model 2 in which the dependent variable is restricted to pairs with positive correlations (about 75% of the observations have positive pair-wise correlations).[12] The results show that the coefficient of *Post-reduction* $_{j,t}$. is negative and significant at the 1% level, indicating that competition, which is triggered by significant reduction in import tariff rates, reduces the correlation between stocks. For example, *Post-reduction* $_{j,t}$ is significantly negative with a value of −0.0318 in Model (1). This estimate suggests that the correlation

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[12] Note that if the pair-wise correlation is negative, then tariff rate reductions should raise correlations toward zero as competition increases mainly the firm-specific risk. Therefore, we measure the dependent variable as the absolute value of average pair-wise correlation between stocks.

Table 9
Regression of changes in pair-wise correlations following reduction in import tariff rates.

	Model 1 Absolute correlations	Model 2 Positive correlations
Intercept	0.35892^{***}	0.40705^{***}
	(0.01819)	(0.02115)
Post-reduction $_{j,t}$	-0.03187^{***}	-0.04424^{***}
	(0.01047)	(0.01189)
Absolute difference of growth $_{(t-1)}$	-0.01412^{***}	-0.01878^{***}
	(0.00434)	(0.00516)
Absolute difference of size $_{(t-1)}$	-0.00304	0.00098445
	(0.0033)	(0.00383)
Absolute difference of BM $_{(t-1)}$	-0.05409^{***}	-0.04364^{**}
	(0.01402)	(0.01740)
Same State $_{(t-1)}$	0.00166	0.00804
	(0.01044)	(0.01189)
Absolute difference of age $_{(t-1)}$	-0.00890	-0.00446
	(0.00713)	(0.00808)
Same listing $_{(t-1)}$	0.09372^{***}	0.08540^{***}
	(0.01043)	(0.01268)
Same index $_{(t-1)}$	0.04149^{***}	0.03708^{***}
	(0.01191)	(0.01421)
Absolute difference of price $_{(t-1)}$	-0.03310^{***}	-0.04314^{***}
	(0.00761)	(0.00957)
Absolute difference of leverage $_{(t-1)}$	-0.23473^{***}	-0.28005^{***}
	(0.04449)	(0.05413)
Same industry $_{(t-1)}$	-0.01147	-0.01078
	(0.01056)	(0.01256)
Adjusted R square	0.1515	0.14
Observations	1,894	1,439

Note: Each observation represents a stock pair year. In Model 1 (2) the dependent variable is the changes in absolute (positive) correlations following reductions in import tariff rates. *Post-reduction* $_{j,t}$ equals one if industry j has experienced a tariff rate reduction by time t that is larger than three times the mean tariff rate reduction in that industry. *Absolute difference of growth* $_{(t-1)}$ is the absolute value difference in 3-year log sales growth rates between two firms in any pair. *Absolute difference of size* $_{(t-1)}$ and *Absolute difference of BM* $_{(t-1)}$ are absolute value difference in size and log book-to-market. Size is the log of the market equity at the fiscal year end in year t. *Same State* is a dummy variable equal to 1 if two firms are in the same state and 0 otherwise.*Absolute difference of age* $_{(t-1)}$ is the absolute value difference between logs of ages of two firms in any pair. Firm age is the difference between the current year and the first year that a firm appears in CRSP plus 1. *Same listing* $_{(t-1)}$ and *Same index* $_{(t-1)}$ are dummy variables equal to 1 if two stocks are listed on the same exchange and S&P industry or economic sector, and 0 otherwise. *Absolute difference of price* $_{(t-1)}$ and *Absolute difference of leverage* $_{(t-1)}$ are the absolute value difference in log prices per share and financial leverage between two firms in any pair. *Same industry* $_{(t-1)}$ is a dummy variable equal to 1 if two firms have the same 4-digit SIC industry code, and 0 otherwise. The sample period is from 1990 to 2005. Standard errors are shown in parenthesis. The symbols ***, ** and * indicate statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

between stocks is lower by 3.18% in the aftermath of a competitive shock, all else equal. The sign of the control variables is in line with prior studies.[13]

7. Conclusion

This paper finds that product market competition increases the proportion of idiosyncratic volatility to systematic volatility. We posit two explanations for this – the pass through channel and the firm ranking. First, market power can work as a hedging instrument to smooth out a firm's idiosyncratic volatility passing increases in costs to higher prices, but not to smooth out its systematic volatility given that all firms are similarly situated. Second, ranking can be driven primarily by changes in firm-specific costs rather than by industry-wide costs, as the former affects a particular firm while the latter affects all firms in the industry.

A panel data set is used to determine the impact of competition on the ratio of idiosyncratic volatility to systematic volatility over the period 2005–14. The Fama–French three-factor model is used to differentiate between idiosyncratic and systematic volatility. The Herfindahl–Hirschman index (*HHI*) and significant reductions in tariff rates are used to measure competition intensity.

Changes in industry-level import tariffs were used to identify industries that experienced decreases in trade barriers -increases in competition- between 1989 and 2005. The results concerning risk confirmed our primary results when using the *HHI* index. We also examined the average pairwise correlation between stock returns to measure the change in systematic volatility relative to the change in idiosyncratic volatility. Comparing between the averages of pairwise return correlations pre- and post- the reduction in tariff rates, we find that the pair-wise correlation decreases following the tariff reductions supporting our prior results. Overall, this study is the first to formally show that competition increases the ratio of unsystematic to systematic risk.

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[13] For example, in Model 2 similar growth rates, book-to-markets, prices and financial leverages between stocks such that absolute differences are smaller lead to higher return correlations. Also, firms that are listed on the same stock exchange or that belong to the same S&P industry or economic sector have higher returns correlations.

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References

Amihud, Y., Lev, B., 1981. Risk reduction as a managerial motive for conglomerate mergers. Bell J. Econ. 605–617.
Ashenfelter, O., Ashmore, D., Baker, J., McKernan, S., 1998. Identifying the Firm-Specific Cost Pass-through Rate. Working paper, Federal Trade Commission.
Barberis, N., Shleifer, A., 2003. Style investing. J. Financ. Econ. 68, 161–199.
Bekaert, G., Hodrick, R., Zhang, X., 2009. International stock return comovements. J. Financ. 64, 2591–2626.
Bergeron, C., 2012. Dividend policy and consumption risk. Int. J. Econ. Financ. 4, p1.
Berk, J., 1995. A critique of size-related anomalies. Rev. Financ. Stud. 8, 275–286.
Bernard, A., Jensen, J., Schott, P., 2006. Trade costs, firms and productivity. J. Monet. Econ. 53, 917–937.
Bernier, G., 1987. Market power and systematic risk: an empirical analysis using Tobin's Q ratio. J. Econ. Bus. 39, 91–99.
Boyer, B., 2011. Style-related comovement: fundamentals or labels? J. Financ. 66, 307–332.
Bustamante, M., Donangelo, A., 2014. Product Market Competition and Industry Returns (Working paper, SSRN 2173985).
Campbell, J., Lettau, M., Malkiel, B., Xu, Y., 2001. Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk. J. Financ. 56, 1–44.
Chen, H., Chen, S., Li, F., 2009. Firm-Level Return Comovement (Working paper).
Fama, E., French, K., 1993. Common risk factors in the returns on stocks and bonds. J. Financ. Econ. 33, 3–56.
Fama, E., MacBeth, J., 1973. Risk, return, and equilibrium: empirical tests. J. Polit. Econ. 607–636.
French, K., Roll, R., 1986. Stock return variances: the arrival of information and the reaction of traders. J. Financ. Econ. 17, 5–26.
Frésard, L., Valta, P., 2013. Competitive Pressure and Corporate Investment: Evidence from Trade Liberalization (Working Paper).
Fu, F., 2009. Idiosyncratic risk and the cross-section of expected stock returns. J. Financ. Econ. 91, 24–37.
Gaspar, M., Massa, M., 2006. Idiosyncratic volatility and product market competition. J. Bus. 79, 3125–3152.
Giroud, X., Mueller, H., 2011. Corporate governance, product market competition, and equity prices. J. Financ. 66, 563–600.
Goyal, A., Santa-Clara, P., 2003. Idiosyncratic risk matters! J. Financ. 58, 975–1007.
Green, T., Hwang, B., 2009. Price-based return comovement. J. Financ. Econ. 93, 37–50.
Grullon, G., Michaely, R., Swaminathan, B., 2002. Are dividend changes a sign of firm maturity? J. Bus. 75 (3), 387–424.
Hamada, R., 1972. The effects of the firm's capital structure on systematic risk of common stocks. J. Financ. 27, 435–452.
Hao, S., Jin, Q., Zhang, G., 2011. Relative firm profitability and stock return sensitivity to industry-level news. Account. Rev. 86, 1321–1347.
Harvey, C., 1991. The world price of covariance risk. J. Financ. 46, 111–157.
Hoberg, G., Prabhala, N., 2009. Disappearing dividends, catering, and risk. Rev. Financ. Stud. 22, 79–116.
Hoberg, G., Phillips, G., Prabhala, N., 2014. Product market threats, payouts, and financial flexibility. J. Financ. 69 (1), 293–324.
Hou, K., Robinson, D., 2006. Industry concentration and average stock returns. J. Financ. 61, 1927–1956.
Irvine, P., Pontiff, J., 2009. Idiosyncratic return volatility, cash flows, and product market competition. Rev. Financ. Stud. 22 (3), 1149–1177.
Jennings, J., Seo, H., Soliman, M., 2015. Relative Performance Ranking: Insights into Competitive Advantage. Washington University and University of Southern California (Working paper).
Julio, B., Ikenberry, D., 2004. Reappearing dividends. J. Appl. Corp. Financ. 16, 89–100.
Karpoff, J., 1987. The relation between price changes and trading volume: a survey. J. Financ. Quant. Anal. 22, 109–126.
Lev, B., 1974. On the association between operating leverage and risk. J. Financ. Quant. Anal. 9, 627–641.
Liew, J., Vassalou, M., 2000. Can book-to-market, size and momentum be risk factors that predict economic growth? J. Financ. Econ. 57, 221–245.
Logue, L., Merville, J., 1972. Financial policy and market expectations. Financ. Manag. 1, 37–44.
Mandelker, G., Rhee, S., 1984. The impact of the degrees of operating and financial leverage on systematic risk of common stock. J. Financ. Quant. Anal. 19, 45–57.
Menchero, J.G., Nagy, Z., Singh, A., 2016. Evaluating the accuracy of beta forecasts. J. Portf. Manag. 42 (3), 84–93 (Spring 2016).
Morck, R., Yeung, B., Yu, W., 2000. The information content of stock markets: why do emerging markets have synchronous price movements? J. Financ. Econ. 58, 215–260.
Moyer, R., Chatfield, R., 1983. Market power and systematic risk. J. Econ. Bus. 35, 123–130.
Pirinsky, C., Wang, Q., 2006. Does corporate headquarters location matter for stock returns? J. Financ. 61, 1991–2015.
RBB Economics, 2014. Cost Pass-Through: Theory, Measurement, and Potential Policy Implications, a Report Prepared for the Office of Fair Trading.
Roll, R., 1988. R-squared. J. Financ. 43, 541–566.
Schott, Peter K., 2015. Data Library. http://faculty.som.yale.edu/peterschott/sub_international.htm.
Subrahmanyam, M., Thomadakis, S., 1980. Systematic risk and the theory of the firm. Q. J. Econ. 94, 437–452.
Tirole, J., 1988. The Theory of Industrial Organization. MIT Press, Cambridge, MA.
Van Horne, C., 1998. Financial Management and Policy, 11th Edition. Prentice Hall, Englewood Cliffs, NJ.
Varela, Oscar, 2015. The stock as a portfolio of durations: solving Black's dividend puzzle using Black's criteria. J. Portf. Manag. 41 (4), 122–132 (Summer).
Xu, Y., Malkiel, B., 2003. Investigating the behavior of idiosyncratic volatility. J. Bus. 76, 613–645.