On the Link between New Stock Listings and Stock Delistings and Average Cross-Sectional Idiosyncratic Stock Volatility

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Annual Meeting of the Southern Economic Association

Atlanta, GA

November 24, 2014

Subject of This Study

- Log-return on stock *i* is represented as:

$$ln(R^i) = \text{drift} + \underbrace{\text{Systematic Risk}}_{\beta_i \times \sigma_m \times W_t} + \underbrace{\text{Idiosyncratic Risk}}_{\sigma_i \times Z_t^i}$$

  - W_t: source of systematic risk (common across all stocks)
  - Z_t^i: source of idiosyncratic risk (specific to stock *i*)

- We study average of σ_i's over all stocks and call it **average idiosyncratic volatility (AIVOL)**

AIVOL and Market Volatility

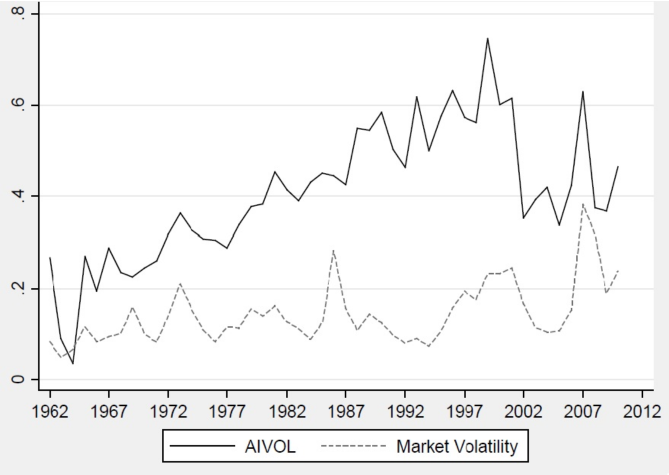

Figure: AIVOL and Market Volatility, 1962–2011

Reasons to Study AIVOL

Average idiosyncratic volatility (AIVOL):

- influences effectiveness of portfolio diversification and performance of portfolio managers (Campbell et al., 2001; Bennett & Sias, 2006)
- affects efficiency of capital allocation via stock market (Durnev et al., 2003; Hamao et al., 2007)
- predicts future stock market returns (Goyal & Santa-Clara, 2003; Guo & Savickas, 2006)
- reflects intensity of "creative destruction" (Chun et al., 2008)
- is a priced risk factor (Ang et al., 2006; Fu, 2009; Guo & Savickas, 2010)

- **Time-series behavior of AIVOL:**
  - Campbell et al. (2001): positive trend between 1962 and 1997
  - Bennett & Sias (2006), Brandt et al. (2010): reversal in trend around 2000
  - Bekaert et al. (2012): no evidence of positive trend overall
- **Factors influencing AIVOL:**
  - Xu & Malkiel (2003): institutional stock ownership
  - Fama & French (2004): number of new stock listings
  - Bennett & Sias (2006): stock market composition
  - Wei & Zhang (2006): level and volatility of return-on-equity
  - Brown & Kapadia (2007): riskiness of publicly traded subsample of the economy
  - Cao et al. (2008): level and variance of corporate growth options
  - Irvine & Pontiff (2009): idiosyncratic volatility of cash flows, intensity of competition
  - Bekaert et al. (2012): industry turnover, growth options, R&D spending, market variance, shocks to industrial production, bond yield spread

Main Findings

- AIVOL is positively associated with contemporaneous number of:
  - newly listed stocks
  - delisted stocks
- AIVOL is positively associated with lagged number of:
  - newly listed stocks
  - delisted stocks
- The results for stock delistings are novel, strong, and robust:
  - we account for autocorrelation of AIVOL
  - we control for aggregate financial/economic variables
  - we perform several specification tests

Note: our AIVOL measure represents average idiosyncratic volatility of surviving stocks

Important Attributes of AIVOL Estimation Approach

- $\text{AIVOL}_{t,t+\tau}$ is average cross-sectional idiosyncratic stock volatility over time period $[t, t+\tau]$
- $\text{AIVOL}_{t,t+\tau}$ is unobservable and must be estimated
- To estimate $\text{AIVOL}_{t,t+\tau}$, stock prices need to be observed only at two time moments: t and $t+\tau$
- We use stock prices adjusted for stock splits, reverse splits, etc.
- We do not consider stocks that were:
  - newly listed between t and $t+\tau$
  - delisted between t and $t+\tau$

Model Structure and Market Index Price Dynamics

- Our financial market model features three types of assets:
  - Many risky assets called stocks
  - A diversified portfolio of stocks called market index
  - A riskless asset (e.g., T-Bill) with risk-free interest rate $r > 0$
- Market index's price, M_t, follows a geometric Brownian motion:

$$\frac{dM_t}{M_t} = \mu_m dt + \sigma_m dW_t$$

  - Drift $\mu_m = r + \delta\sigma_m$
  - δ: market risk premium
  - $\sigma_m > 0$: market volatility
  - W_t: standard Brownian motion, source of systematic risk

Stock Price Dynamics

- Price of stock i, S_t^i, follows a geometric Brownian motion:

$$\frac{dS_t^i}{S_t^i} = \mu_i dt + \beta_i \sigma_m dW_t + \sigma_i dZ_t^i$$

  - W_t: standard Brownian motion, source of systematic risk
  - Z_t^i: standard Brownian motion, source of idiosyncratic risk
  - W_t and Z_t^i are mutually independent
  - Drift $\mu_i = r + \delta\beta_i\sigma_m + \gamma\sigma_i$
  - γ: idiosyncratic risk premium
  - β_i: beta of stock i, $\beta_i \sim i.i.d.UNI[\kappa_\beta, \kappa_\beta + \lambda_\beta]$
  - σ_i: idiosyncratic volatility of stock i, $\sigma_i \sim i.i.d.UNI[0, \lambda_\sigma]$

- AIVOL $= \lambda_\sigma/2$, where λ_σ is estimated using GMM-based approach of Khovansky & Zhylyevskyy (2013)

Data

- Source of stock data: Center for Research in Security Prices (**CRSP**)
- Time frame: 1962–2011
- We construct 12 time series of annual AIVOL estimates. Each series has 49 observations and is based on non-overlapping periods falling on a particular month:
  - January series, 49 periods:
    - first Wednesday of January 1962–first Wednesday of January 1963
    - first Wednesday of January 1963–first Wednesday of January 1964

      ...
    - first Wednesday of January 2010–first Wednesday of January 2011

  ...
  - December series, 49 periods:
    - first Wednesday of December 1962–first Wednesday of December 1963

      ...
    - first Wednesday of December 2010–first Wednesday of December 2011
- For same periods, we construct time series of numbers of new stock listings and delistings using CRSP stock header files

Contemporaneous Regression Results

- Before running regressions, we test all time series for unit root and find them to be stationary
- Contemporaneous regressions have following form:

$$\ln\left(AIVOL_t\right) = a_0 + a_1 \cdot \ln\left(n_t\right) + a_2 \cdot \ln\left(AIVOL_{t-1}\right) + a_3 \cdot nasdaq_t + \epsilon_t$$

n_t: number of new listings OR number of delistings during period t

	Log of Stock Numbers			
	Newly Listed		**Delisted**	
	Coeff.(a_1)	(Std.Err.)	Coeff.(a_1)	(Std.Err.)
January series	0.1903**	(0.0756)	0.4350***	(0.0848)
February series	0.1812**	(0.0682)	0.3304***	(0.0795)
March series	0.2510**	(0.0998)	0.3591***	(0.1036)
...	...	...	...	...
December series	0.2032**	(0.0861)	0.3972***	(0.0935)

Lagged Regression Results

- We regress AIVOL on first lag of number of new listings or delistings. Regressions have following form:

$$\ln(AIVOL_t) = b_0 + b_1 \cdot \ln(n_{t-1}) + b_2 \cdot \ln(AIVOL_{t-1}) + b_3 \cdot nasdaq_{t-1} + \varepsilon_t$$

n_{t-1}: number of new listings OR number of delistings during $t-1$

	First Lag of Log of Stock Numbers			
	Newly Listed		Delisted	
	Coeff.(b_1)	(Std.Err.)	Coeff.(b_1)	(Std.Err.)
January series	0.1418*	(0.0734)	0.4429***	(0.0778)
February series	0.1645**	(0.0663)	0.3639***	(0.0718)
March series	0.2671***	(0.0963)	0.3604***	(0.0977)
...	...	...	...	...
December series	0.2561***	(0.0850)	0.3566***	(0.0965)

- Regressions are also run for delistings differentiated by delisting reason: merger, stock-issue exchange, pre-announced liquidation, drop

Selected Aggregate Variables That May Affect AIVOL

- **MABA**: average ratio of market value of assets to book value of assets among publicly traded firms
- **RD**: average ratio of research and development expenditures to sales
- **Small**: percentage of total market capitalization attributable to smallest (by market value) quartile of firms
- **Std(SP500)**: standard deviation of daily returns on S&P 500 index
- **VIX**: VIX index (measures implied volatility of S&P 500 index options)

Contemporaneous Regression with New Listings and AV Controls

Estimated regressions:

$$\ln(AIVOL_t) = a_0 + a_1 \cdot \ln(n_t) + a_2 \cdot av_t + a_3 \cdot \ln(AIVOL_{t-1}) + a_4 \cdot nasdaq_t + \epsilon_t$$

n_t: number of newly listed stocks during period t

av_t: aggregate variable for period t

	Aggregate Variable		**Log # of New Listings**	
	Coeff.(a_2)	(Std.Err.)	Coeff.(a_1)	(Std.Err.)
ln(MABA)	-0.0470	(0.1331)	0.1951^{**}	(0.0868)
ln(RD)	0.0871^{**}	(0.0331)	0.1397^{**}	(0.0655)
Small	-0.6094^{**}	(0.2803)	0.2089^{**}	(0.0784)
Std(SP500)	0.4216^{***}	(0.1508)	0.2733^{***}	(0.0926)
VIX	0.0296^{**}	(0.0121)	0.2511^{***}	(0.0897)

Note: We use time series for annual periods starting in January

- Each regression fails at least one specification test: RESET, alternative Durbin, or Fan & Li (1999) test

Contemporaneous Regression with Delistings and AV Controls

Estimated regressions:

$$\ln(AIVOL_t) = a_0 + a_1 \cdot \ln(n_t) + a_2 \cdot av_t + a_3 \cdot \ln(AIVOL_{t-1}) + a_4 \cdot nasdaq_t + \epsilon_t$$

n_t: number of delisted stocks during period t

av_t: aggregate variable for period t

	Aggregate Variable		**Log # of Delistings**	
	Coeff.(a_2)	(Std.Err.)	Coeff.(a_1)	(Std.Err.)
ln(MABA)	-0.0777	(0.1299)	0.4425***	(0.1445)
ln(RD)	0.0476**	(0.0233)	0.3563***	(0.1234)
Small	0.0633	(0.2417)	0.4474**	(0.1695)
Std(SP500)	0.1840***	(0.0600)	0.4015***	(0.1277)
VIX	0.0142*	(0.0075)	0.4137***	(0.1250)

Note: We use time series for annual periods starting in January

- Log # of delistings remains statistically significant in all cases
- Regressions for ln(MABA) and Small fail alternative Durbin test (at 5% level)

Lagged Regression with New Listings and AV Controls

Estimated regressions:

$$\ln(AIVOL_t) = b_0 + b_1 \cdot \ln(n_{t-1}) + b_2 \cdot av_{t-1} + b_3 \cdot \ln(AIVOL_{t-1}) + a_4 \cdot nasdaq_{t-1} + \varepsilon_t$$

n_{t-1}: number of newly listed stocks during period $t-1$

av_{t-1}: aggregate variable for period $t-1$

Lagged:	**Aggregate Variable**		**Log # of New Listings**	
	Coeff.(b_2)	(Std.Err.)	Coeff.(b_1)	(Std.Err.)
ln(MABA)	0.2643	(0.1823)	0.1115	(0.1199)
ln(RD)	0.0871**	(0.0343)	0.1022	(0.1031)
Small	-0.4768**	(0.2002)	0.1506	(0.1187)
Std(SP500)	0.0956	(0.2161)	0.1594	(0.1531)
VIX	0.0073	(0.0153)	0.1553	(0.1377)

Note: We use time series for annual periods starting in January

- Lagged log # of new listings loses statistical significance when a lagged aggregate variable is added to a regression
- Each regression fails at least two specification tests out of three performed

Lagged Regression with Delistings and AV Controls

Estimated regressions:

$$\ln(AIVOL_t) = b_0 + b_1 \cdot \ln(n_{t-1}) + b_2 \cdot av_{t-1} + b_3 \cdot \ln(AIVOL_{t-1}) + b_4 \cdot nasdaq_{t-1} + \varepsilon_t$$

n_{t-1}: number of delisted stocks during period $t-1$

av_{t-1}: aggregate variable for period $t-1$

Lagged:	**Aggregate Variable**		**Log # of Delistings**	
	Coeff.(b_2)	(Std.Err.)	Coeff.(b_1)	(Std.Err.)
ln(MABA)	0.0791	(0.1231)	0.4310^{***}	(0.1368)
ln(RD)	0.0343	(0.0226)	0.3869^{***}	(0.1215)
Small	0.1775	(0.2597)	0.4736^{***}	(0.1533)
Std(SP500)	-0.0054	(0.1142)	0.4429^{***}	(0.1276)
VIX	-0.0018	(0.0096)	0.4440^{***}	(0.1263)

Note: We use time series for annual periods starting in January

- Lagged log # of delistings remains statistically significant in all cases
- Each regression passes all specification tests performed

Discussion

- Number of delistings is positively associated with AIVOL of surviving stocks, both contemporaneously and with a lag
- Results for delistings are robust to accounting for other variables that can influence AIVOL, including aggregate variables
- Possible mechanism underlying our results:
  - Delistings can indicate changes in economic environment, including changes in the number of competitors. Under Cournot competition, such changes can contribute to variability of firm profits and stock valuations
  - Delistings can increase investor uncertainty about future firm profitability. The model of Pástor & Veronesi (2003) would then predict a rise in individual idiosyncratic volatilities and an increase in AIVOL as a result
- Number of delistings is an important variable to keep track of for stock market investors and other financial practitioners

Thank you!

Questions?

Appendix: Number of New Stock Listings, 1962–2011

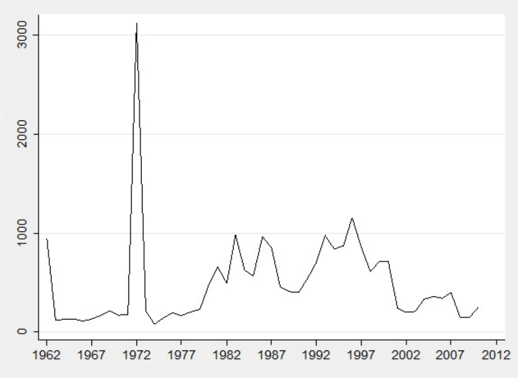

Figure: # of new listings for annual periods starting in December

Appendix: Number of Stock Delistings, 1962–2011

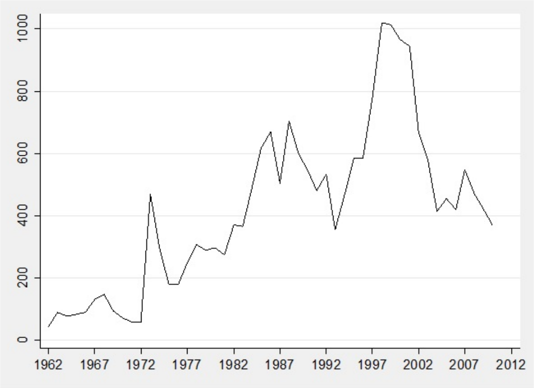

Figure: # of delistings for annual periods starting in December

Appendix: Selected Aggregate Variables and AIVOL

These regressions focus on aggregate variables and do not include log numbers of new listings and delistings as regressors

- Contemporaneous regressions:

$$\ln(AIVOL_t) = a_0 + a_1 \cdot av_t + a_2 \cdot \ln(AIVOL_{t-1}) + a_3 \cdot nasdaq_t + \epsilon_t$$

- Lagged regressions:

$$\ln(AIVOL_t) = b_0 + b_1 \cdot av_{t-1} + b_2 \cdot \ln(AIVOL_{t-1}) + b_3 \cdot nasdaq_{t-1} + \varepsilon_t$$

	Contemporaneous		**Lagged**	
	Coeff.(a_1)	(Std.Err.)	Coeff.(b_1)	(Std.Err.)
ln(MABA)	0.0945	(0.1336)	0.3672**	(0.1497)
ln(RD)	0.0997***	(0.0360)	0.0936**	(0.0354)
Small	-0.5328**	(0.2471)	-0.4306**	(0.1873)
Std(SP500)	0.2877***	(0.1031)	0.0015	(0.1418)
VIX	0.0205*	(0.0107)	0.0010	(0.0124)

Note: We use time series for annual periods starting in January