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

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## 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 $\sigma_i$'s over all stocks and call it **average idiosyncratic volatility (AIVOL)**

# AIVOL and Market Volatility

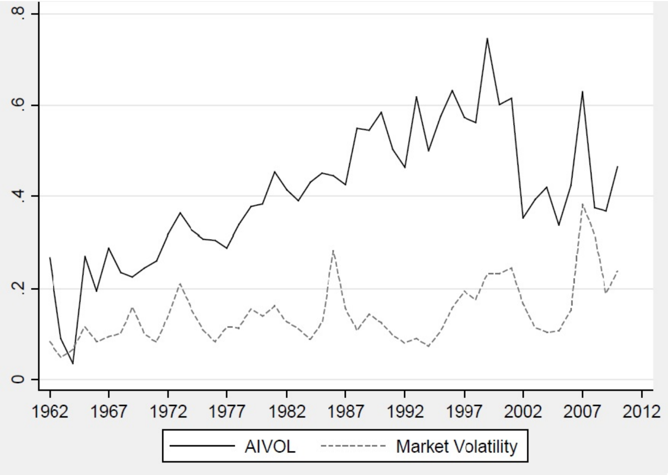


**Figure:** AIVOL and Market Volatility, 1962–2011

# 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)
- is a priced risk factor (Ang et al., 2006; Fu, 2009; Guo & Savickas, 2010)
- reflects intensity of "creative destruction" (Chun et al., 2008)

# Previous Literature

- **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 dynamics:**
  - Pástor & Veronesi (2003), Fama & French (2004): number of new stock listings
  - Xu & Malkiel (2003): institutional stock ownership
  - 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
  - Chun et al. (2008): intensity of "creative destruction" in the economy
  - 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 among 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 $t+\tau$
- When estimating $\text{AIVOL}_{t,t+\tau}$, we do not consider stocks that were:
  - newly listed between $t$ and $t+\tau$
  - delisted between $t$ and $t+\tau$
- We use stock prices adjusted for stock splits, reverse splits, etc.

# Model Structure and Market Index 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 $\mu_m = r + \delta\sigma_m$
  - $\delta$: 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:

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

  - $i = 1, 2, \ldots$ indexes stocks
  - $W_t$: standard Brownian motion, source of systematic risk
  - $Z_t^i$: standard Brownian motion, source of idiosyncratic risk
  - $W_t$ and $Z_t^i$ are independent $\forall i$, $Z_t^i$ and $Z_t^j$ are independent $\forall i \neq j$
  - drift $\mu_i = r + \delta\beta_i\sigma_m + \gamma\sigma_i$
  - $\gamma$: idiosyncratic risk premium
  - $\beta_i$: beta of stock $i$, $\beta_i \sim i.i.d.UNI[\kappa_\beta, \kappa_\beta + \lambda_\beta]$
  - $\sigma_i$: idiosyncratic volatility of stock $i$, $\sigma_i \sim i.i.d.UNI[0, \lambda_\sigma]$

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

# Data for Empirical Analysis

- 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 and 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 the 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 performed specification tests

## Concluding Remarks: Novelty and Contribution

- Number of stock delistings explains and predicts the dynamics of AIVOL among surviving stocks
  - An increase in the number of delistings may disrupt investor learning about future prospects of surviving stocks
  - In that case, the model of Pástor & Veronesi (2003) would predict a rise in idiosyncratic volatilities among surviving stocks
- Our results for delistings are robust to accounting for other variables that can explain or predict AIVOL
- Number of delistings may be indicative of the intensity of "creative destruction." Because of the link to AIVOL, financial investors may be negatively affected by economic forces contributing to long-run growth

Thank you!

Questions?

# Appendix: Number of New Stock Listings, 1962–2011

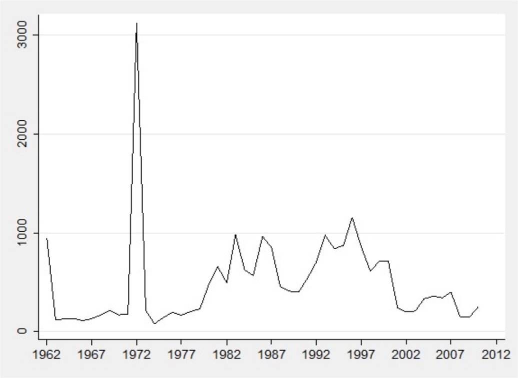


**Figure:** # of new listings for annual periods starting in December

## Appendix: Number of Stock Delistings, 1962–2011

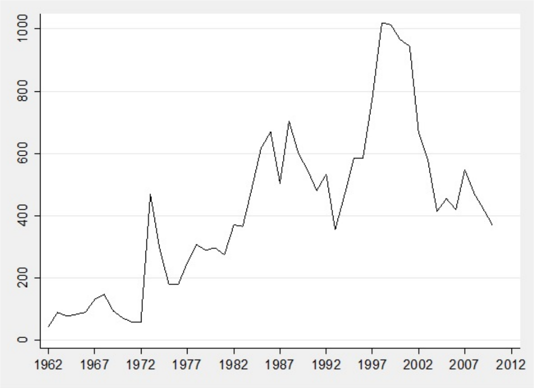


**Figure:** # of delistings for annual periods starting in December

## 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