

R^2 and the Economy

Randall Morck,^{1,2} Bernard Yeung,³ and Wayne Yu⁴

¹Department of Finance and Statistical Analysis, Alberta School of Business, University of Alberta, Edmonton, Alberta, Canada T6E 2R6; email: randall.morck@ualberta.ca

²National Bureau of Economic Research, Cambridge, Massachusetts 02138

³Department of Finance and Strategic Management, Business School, National University of Singapore, Singapore 119245; email: byeung@nus.edu.sg

⁴School of Accounting and Finance, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong; email: afwyu@polyu.edu.hk

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Abstract

The characterization of firm-specific return volatility as the intensity with which firm-specific events occur reconciles many seemingly discordant results. A functionally efficient stock market allocates capital to its highest value uses, which often amounts to financing Schumpeterian creative destruction, wherein creative winner firms outpace destroyed losers, who could be the previous year's winners. This rise in firm-specific fundamentals volatility elevates firm-specific return volatility in a sufficiently informationally efficient stock market. These linkages are interconnected feedback loops rather than unidirectional chains of causality.

1. INTRODUCTION

Asked to predict the market, J.P. Morgan famously snapped, “It will fluctuate” (Strouse 1999, p. 11). Finance theory partitions those fluctuations into firm-specific fluctuations, affecting few (or just one) stocks, and market-wide fluctuation, affecting all (or most) stocks. This partition matters because firm-specific fluctuations cancel in a diversified portfolio, but market-wide fluctuations do not—and so are unavoidable risks. This simplifies finance research in two ways. First, asset pricing models can focus on unavoidable market-wide factors by assuming investors are diversified, leaving firm-specific fluctuations a residual afterthought. Second, corporate finance researchers can use event studies, which subtract out market-wide fluctuations, isolating firm-specific fluctuations associated with events that alter firms’ fundamental values. Each subdiscipline’s afterthought is the other’s focus.

Roll (1988) observes that most fluctuations in US share prices are firm-specific. Morck, Yeung & Yu (2000) confirm this, but also find market-wide fluctuations far more important in earlier twentieth-century US data, and in emerging markets, especially where corruption is severe. Campbell et al. (2001) affirm rising firm-specific risk in US stocks from 1962 to 1997 and explore its econometric characteristics. Similar increases in firm-specific risk appear in other developed (Guo & Savickas 2008) and emerging (Li et al. 2004) economies.

A large literature exploring these findings can appear inconsistent but actually coalesces into a coherent, albeit tentative, explanation if firm-specific return volatility is characterized as firm-specific return event intensity. Here, event connotes a firm-specific valuation change that, if accompanied by a public announcement, an event study might investigate. In this sense, in an efficient market, firm-specific return volatility necessarily measures the intensity of information events being capitalized into share prices (French & Roll 1986). A growing literature exploring these issues has implications about the role of stock markets in economic development.

First, firm-specific return event intensity correlates with financial development and with market efficiency, particularly Tobin’s (1984) concept of functional efficiency, the stock market’s reliability in allocating capital to its highest value uses. Institutional changes that plausibly make arbitrage less costly presage elevated firm-specific return event intensity. This reinforces Roll’s (1988) argument that firm-specific risk reflects informed investors moving share prices—market efficiency in action.

Second, firm-specific return event intensity correlates with economic dynamism, over time and across countries. Intuitively, more intensive innovation corresponds to more (or more important) events raising the volatility of firm-specific fundamentals and returns (Chun et al. 2008; Chun, Kim & Morck 2011). Schumpeter’s (1911) creative destruction, in particular, separates the firm-specific valuations of creative winner firms from those of laggard loser firms. Intensified creative destruction elevates what we call firm-specific fundamentals event intensity, and an informationally efficient stock market reflects this in elevated firm-specific return event intensity.

Laws, regulations, and other institutional features plausibly affect economic growth in ways associated with event intensity. Specifically, institutions that render financial markets more functionally efficient also likely encourage creative destruction and thereby promote economic dynamism. However, various feedback effects make unidirectional causality unlikely.

2. R^2

Workhorse models of asset pricing theory explain any individual stock’s return with changes in one or more economy-level common pricing factors. The simplest such framework, the capital asset pricing model (CAPM), represents the expected return of stock j as

$$\tilde{r}_{j,t} = r_f + \beta_j(r_{m,t} - r_f), \quad (1)$$

where $r_{m,t}$ is the return on a fully diversified portfolio of assets, and r_f is the risk-free return. The coefficient β_j relates the stock's return to the sole pricing factor, the equity risk premium $r_{m,t} - r_f$. Key parameters of Equation 1 are often operationally approximated using market model regressions of the form

$$r_{j,t} = \alpha_j + \beta_j r_{m,t} + e_{j,t}, \quad (2)$$

where $e_{j,t}$ is the residual component of stock j 's return not explained by the equity risk premium, and $\alpha_j = (1 - \beta_j)r_f$ is nonstochastic.¹

The nonstochastic nature of α_j and the orthogonality of Regression 2's errors $e_{j,t}$ from its explanatory variable permit the variance decomposition

$$\text{variance}[r_{j,t}] = \underbrace{\text{variance}[\beta_j r_{m,t}]}_{\substack{\text{market-wide} \\ \text{variation}}} + \underbrace{\text{variance}[e_{j,t}]}_{\substack{\text{firm-specific} \\ \text{variation}}}, \quad (3)$$

where variance $[\beta_j r_{m,t}]$ is the *market-wide variation* in the stock's return, and variance $[e_{j,t}]$ is the *firm-specific variation* in its return.

Roll (1988) notes that the regression R_j^2 of Regression 2 is

$$\begin{aligned} R_j^2 &= \frac{\text{explained variation}}{\text{explained variation} + \text{residual variation}} \\ &= \frac{\text{market-wide variation}}{\text{firm-specific variation} + \text{market-wide variation}}, \end{aligned} \quad (4)$$

and thus measures both the goodness of fit of the market model for stock j 's returns data and the fraction of the variation in stock j 's return related to market-wide fluctuations. In econometrics, a lower R_j^2 indicates a worse model, but here this rule of thumb fails. A lower R_j^2 merely means that more of the variation in stock j 's price is firm-specific—the stock's returns are less synchronous with the overall market. From a finance perspective, this is arguably good, in that firm-specific variation is diversifiable. Obviously,

$$1 - R_j^2 = \frac{\text{firm-specific variation}}{\text{firm-specific variation} + \text{market-wide variation}} \quad (5)$$

likewise measures the firm-specific fraction of the risk in stock j 's returns, the stock's tendency to move asynchronously from the market. To stress that the market model R_j^2 is more than a statistical goodness of fit, we call R_j^2 stock j 's synchronicity and $1 - R_j^2$ its asynchronicity.

Greater firm-specific return event intensity, as defined in the introduction, corresponds to higher firm-specific variation in Equations 4 and 5, and thus, all else equal, to less synchronous stock returns. As we elaborate below, all else is seldom equal.

2.1. R^2 Over Time in the United States

Figure 1a graphs the annual mean R^2 's of Regression 2 for US stocks from 1926 through 2010. For each stock in each year, weekly returns are regressed on the CRSP value-weighted market return.

¹The CAPM and market model are conceptually distinct. The former derives from a stylized model of investor behavior; the latter is a purely empirical proposition.

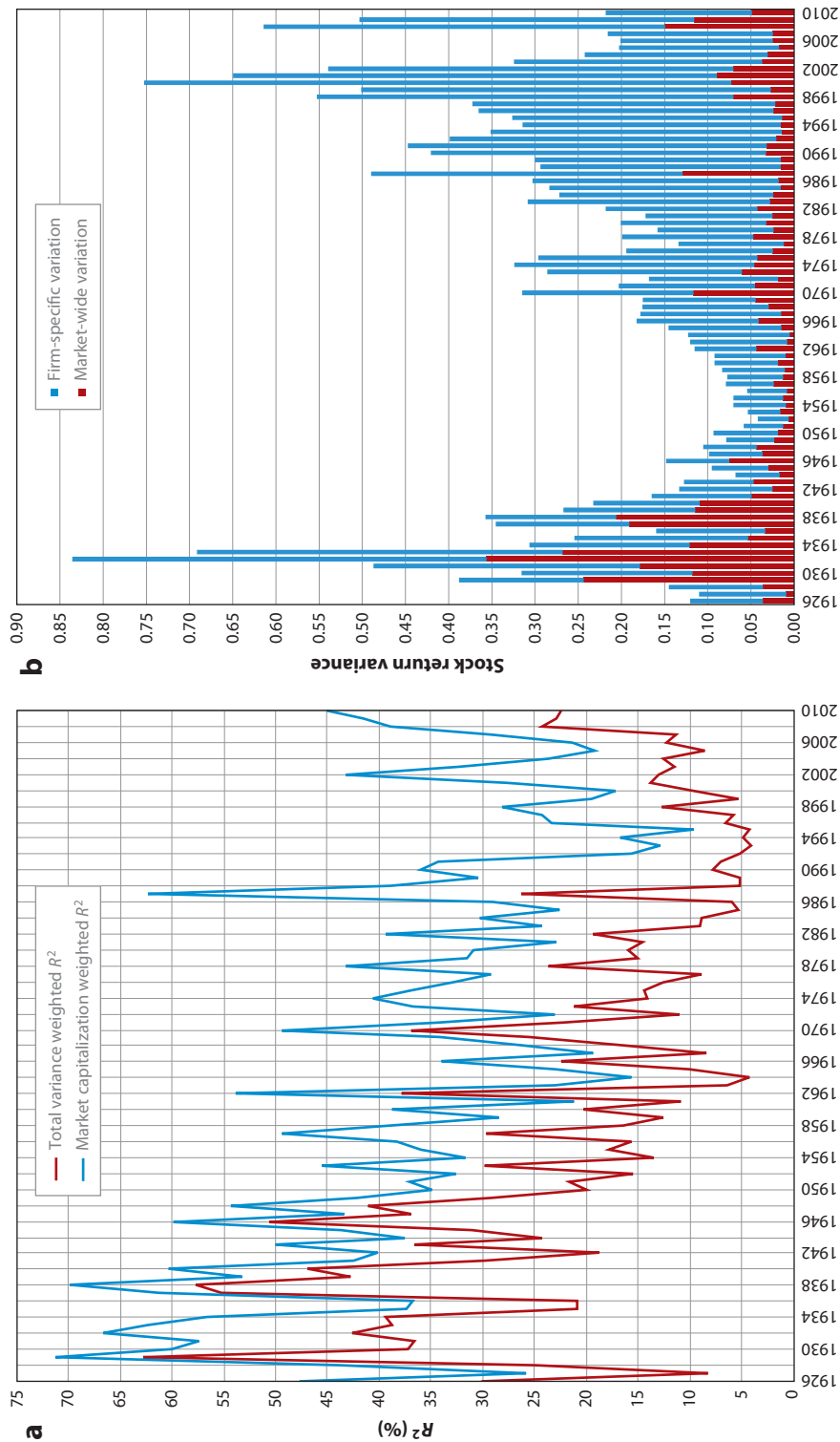


Figure 1

US stock comovement between 1926 and 2010. (a) R^2 is the mean across all stocks of the market model regressions of a US stock's weekly (Wednesday–Wednesday) CRSP total return on the contemporaneous CRSP value-weighted total market return. Means are weighted by either total return variation or market capitalization. (b) Market-wide variation is the mean across all US stocks of the sum-of-squared variation explained by those market model regressions. Firm-specific variation is the corresponding residual variation.

To mitigate data errors, weekly returns are Winsorized at 99.9%, and weeks with missing or zero trading volume are removed. Also, firms with fewer than 30 valid weekly returns in a year are dropped. The mean R^2 each year is then calculated as in Equation 4—first replicating Morck, Yeung & Yu (2000) and weighting firms by total returns variation, then weighting by beginning-of-year market capitalization.

Both mean R^2 s fall steadily through the mid-1990s, replicating Morck, Yeung & Yu (2000), but then rise again after 2000, and by 2008 regain levels that, except around 1987's stock market crash, were unseen since the 1970s. Weighting by beginning-of-year market capitalization produces higher R^2 s throughout, consistent with larger firms' greater importance in the index. Alternative approaches—not Winsorizing, dropping extreme observations, or using the methodology of Campbell et al. (2001)—all generate broadly similar patterns.

Figure 1b links the late twentieth-century R^2 decline to escalating firm-specific variation, more than declining market-wide variation; however, the latter is also detectable in what macroeconomists dub the Great Moderation (Taylor 2000, Blanchard & Simon 2001, Comin & Mulani 2006). Again, this pattern reverses, at least temporarily, in the early twenty-first century. Explanations of why firm-specific variation and systematic risk change over time must account for this complete pattern, not just the trends in the late twentieth century.

2.2. R^2 Across Countries

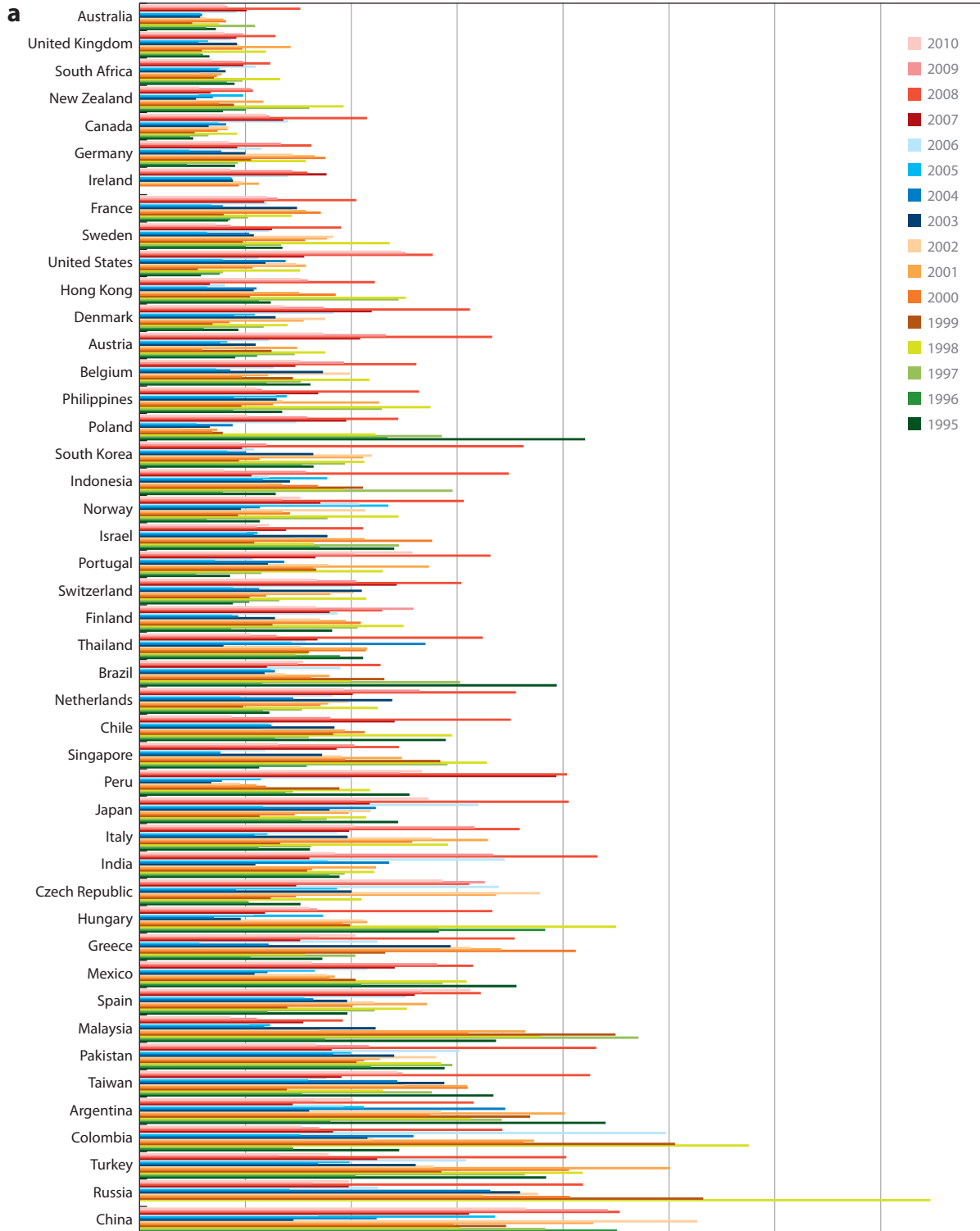
Figure 2a ranks countries by the grand means of their mean R^2 s for 1995 through 2010. The lesser synchronicity of higher-income countries' stocks evident in panel *a* is confirmed in panel *b*, which graphs each country's grand mean firm-level R^2 s against its mean log of per capita GDP, averaged over the same 1995-through-2010 period. Both panels show as persisting the pattern Morck, Yeung & Yu (2000) observed in the 1990s. Even their reported major anomaly persists: Japanese stocks remain oddly synchronous given the country's high per capita GDP.

One major difference between Morck, Yeung & Yu's (2000) observations and **Figure 3** is that American stocks, the most idiosyncratic in the 1990s, became more synchronous over time, leaving its stocks only the tenth most asynchronous in the figure. Another is that Polish stocks, among the most synchronous in the world in the 1990s, became quite idiosyncratic over time. Yet another difference is South African stocks' marked asynchronicity, given its relatively low per capita income.

3. MARKET EFFICIENCY AND CAPITAL ALLOCATION

Higher firm-specific stock return volatility can signify more firm-specific stock return event intensity. All else equal, this would indicate more nuanced stock price movements more accurately reflecting similar underlying firm-specific fundamentals events. All else is seldom equal, but Durnev et al. (2003) nonetheless explore this possibility and find that future earnings changes better explain the current stock returns of firms in US industries, where stock returns are also less synchronous. Because the power of future earnings changes to explain current stock returns is a widely accepted measure of stock market informativeness in the accounting literature (Collins et al. 1994, Basu 1997), they conclude that elevated firm-specific return event intensity reflects more informationally efficient stock pricing.

Further development of this line of reasoning requires an exploration of the determinants of market efficiency. Fama (1970) describes the stock market as more informationally efficient if share prices adjust faster and more completely to new information. Informational efficiency can reflect private arbitrageurs gathering new information, reassessing firms' fundamental values, and



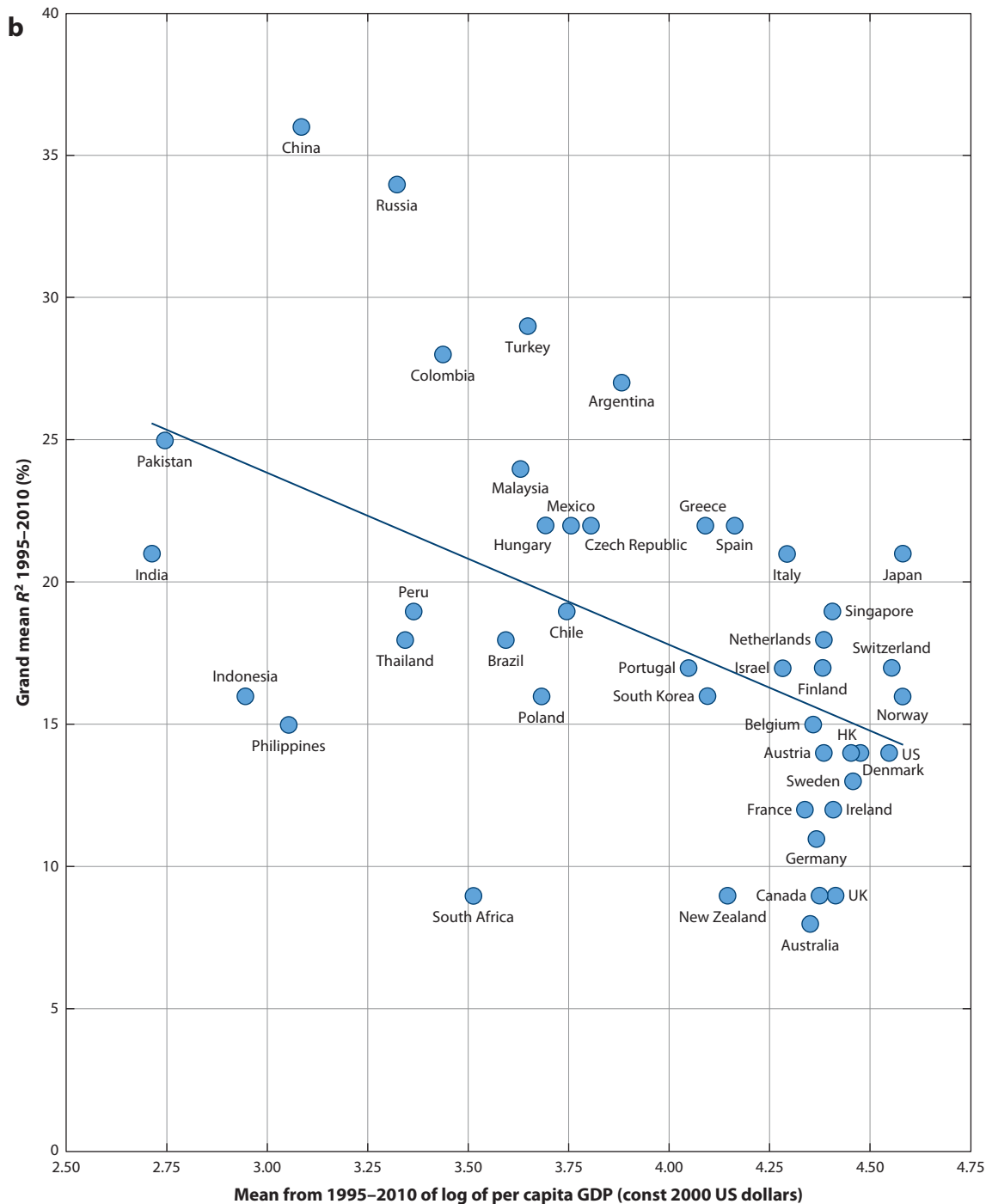


Figure 2

Less synchronous stock returns in higher-income economies. (a) The mean of stock-level market model R^2 , by year from 1995 through 2010, for each country, estimated using weekly (Wednesday–Wednesday) *DataStream* total returns and country total return indexes. Countries are sorted by their mean R^2 over all years. (b) Country means of the stock-level market model R^2 's from panel a are plotted against the log of per capita GDP (constant 2000 US dollars). Both are means for the 1995–2010 period.

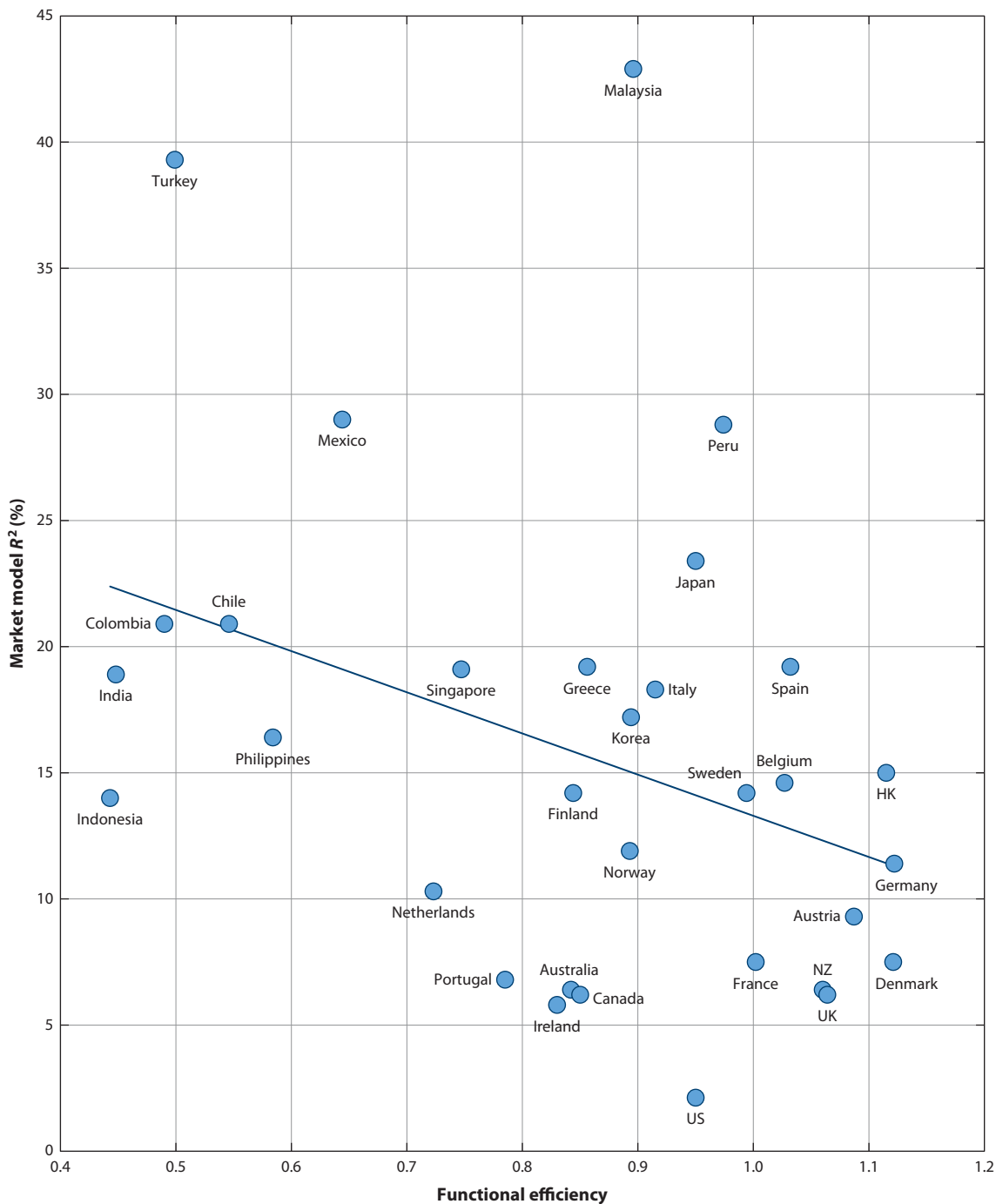


Figure 3

Functional efficiency and R^2 . Higher functional efficiency, indicated by a greater concentration of capital spending in industries with higher value-added, correlated with lower R^2 . Functional efficiency is from Wurgler (2000), and R^2 is from Morck, Yeung & Yu (2000). Both measures are based on mid-1990s data.

trading to profit from those reassessments (Grossman 1976); more meaningful public announcements (Fama et al. 1969); or more energetic insider trading (Manne 1966). Each can push stock prices toward fundamental values, all else equal, raising informational efficiency where informed arbitrage is less costly, disclosure fuller and timelier, or insider trades more informative.

3.1. Private Information-Based Arbitrage

French & Roll (1986) and Roll (1988) argue that firm-specific fluctuations reflect more than just public news announcements, and they credit private arbitrage for much stock price fluctuation. That is, they attribute firm-specific return volatility to firm-specific fundamentals event intensity. Consistent with this, Berry & Howe (1994) detect no relationship between the incidence of public news and firm-specific stock returns. Although recent work (e.g., Boudoukh et al. 2013) contests this conclusion, we consider it for the moment.

If private arbitrageurs are an important force pushing prices toward fundamental values, arbitrageurs' costs of business affect the informational efficiency of the stock market (Grossman & Stiglitz 1980). This linkage suggests that higher firm-specific variation in higher-income countries and in the late twentieth century might reflect arbitrageurs' falling costs or rising trading revenues.

In a dynamic model with discrete fixed costs of information gathering and processing, Veldkamp (2006) formalizes this. Competition biases information suppliers toward producing information useful for estimating the fundamental values of many firms because this has more buyers than information about one stock. Higher fixed costs of information production extenuate this, leading to even less production of information about individual firms. Thus, where arbitrage fixed costs are higher, more investors trade *en masse* on the basis of the same information about the same subset of stocks, rendering returns more synchronous.

The economics of the information production industry reconciles several seemingly discordant findings. Stocks followed by more analysts comove more in the United States (Piotroski & Roulstone 2004) and elsewhere (Chan & Hameed 2006), and changes in their fundamentals also correlate more closely with changes in the fundamentals of more other firms (Hameed et al. 2010). All these findings are consistent with Veldkamp (2006), as is evidence that analysts' forecasts contain mainly industry- and economy-level information (Schutte & Unlu 2009; Crawford, Roulstone & So 2012).² Presumably, firm-specific information enters stock prices via other channels.

Stocks move more independently after emerging markets lower inward foreign portfolio investment barriers (Li et al. 2004); receive increased equity investment inflows from the United States (Bae, Bailey & Mao 2006); announce stock market liberalizations (Bae, Bailey & Mao 2006); or allow cross-listings or closed-end country funds into the United States, the United Kingdom (Bae, Bailey & Mao 2006), or Hong Kong (Gul, Kim & Qiu 2010). These findings also fit the pattern if foreign arbitrageurs raise the intensity and sophistication of informed trading.

More binding short-sale restrictions correlate positively with stock return synchronicity (Bris, Goetzmann & Zhu 2007). Arbitrageurs with information that a stock is overvalued profit from short selling—borrowing an overpriced stock, selling it, and repurchasing and returning it after the price falls. Some countries ban short selling, presumably reducing the value of roughly half of all nonpublic information. Bris, Goetzmann & Zhu (2007) distinguish a downside R^2 , which measures stock return comovement when the market return is negative, from an upside R^2 , which

²The latter add that analysts initiating coverage on firms already followed by other analysts appear to generate firm-specific information.

measures stock return comovement when the market return is nonnegative. They find short-sales restrictions correlating most strongly with their downside R^2 . Chang et al. (2012) replicate this using firm-level data in Hong Kong.

Who the informed arbitrageurs are is less clear. Malkiel & Xu (2002) find higher firm-specific return volatility in stocks whose institutional ownership is larger and argue that this reflects noise trading by institutions. Chung et al. (2011) advance an alternative explanation more consistent with the noise trading literature (DeLong et al. 1990): Larger institutional investors' economies of scale better cover the fixed costs of information (Veldkamp 2006). They find, in support of this idea, that firm-specific variation positively correlates with the stakes of hedge funds, a genre of institutional investor thought to specialize in informed arbitrage (Chun, Kim & Morck 2011). Piotroski & Roulstone (2004) revisit institutional investors in general and report higher return synchronicity in stocks with less institutional trading. Ferreira & Laux (2007) find institutional stakes positively correlated with firm-specific variation around mergers for firms unprotected from takeovers (Gompers, Ishii & Metrick 2003).

These findings coalesce into Veldkamp's (2006) theory of fixed costs of information limiting informed arbitrage. Hedge funds may act as firm-specific information generators, as may other institutional investors, in at least some circumstances. Analysts appear to generate information the market interprets as more broadly relevant. The roles of other classes of potential private arbitrageurs remain unclear. Institutional environments (restrictions on foreign investors, short sales, etc.) or economic conditions (recessions, etc.) that increase the net effect of fixed information costs correlate with less independent stock returns.

3.2. Public Information Announcements

Boudoukh et al. (2013), using advanced text analysis software (Feldman et al. 2011), find a larger fraction of firm-specific stock price movements corresponding to identifiable public news announcements than did Roll (1988). Their methodology combines machine learning with word-level (Tetlock 2007, Loughran & McDonald 2011) and phrase-level text analysis rules to gauge some 1.9 million news articles' tone and relevance to specific companies from 2000 to 2009. This lets them link public news with stock returns far more reliably and use this information to explain when stocks move idiosyncratically as opposed to with the market. Their median estimated stock-level return R^2 is 16% on dates their algorithm designates "news days," down from 28% on "no news days." This linkage suggests that the public release of news, a very straightforward indicator of events happening, indeed correlates with stock return asynchronicity.

News services are one source of public information; financial disclosure is another. Morck, Yeung & Yu (2000) report no correlation between firm-specific return volatility and a measure of national disclosure standards' comprehensiveness. However, comprehensive standards are unimportant if the numbers are uninformative; and measures of disclosure quality do correlate with lower synchronicity (Lau, Ng & Zhang 2012).³ Moreover, firm-specific return volatility rises after countries adopt International Financial Reporting Standards (IFRS), especially for countries with worse institutional environments, where IFRS likely most improves disclosure quality (Bissessur & Hodgson 2012, Kim & Shi 2012). Also consistent with this reasoning, Fox et al. (2003) find that an increase in US disclosure requirements in 1980 raised firm-specific return variation in the years immediately thereafter, but only for firms most affected by the change. Once again, this ties firm-specific return volatility to firm-specific event intensity.

³Their risk premium volatility, by construction, measures synchronicity.

Jin & Myers (2006) model insiders' appropriating firm-specific, but not market-wide, abnormal profits as an explanation of low firm-specific stock return variation in countries where de facto disclosure standards are low. Consistent with this, they report economy-level measures of firm-level disclosure quality positively correlated with firm-specific return variation, as well as other evidence supporting their model. These findings suggest that differences in the strength of public investors' property rights over the wealth their firms generate might help explain cross-country differences in stock return synchronicity. Also supporting Jin & Myers' model, Hutton, Marcus & Tehranian (2009) find firm-specific return variation negatively correlated with accruals management, which they interpret as measuring management's preference for opacity in US firms. Moreover, this relationship vanished with the passage of the Sarbanes-Oxley Act (2002), which limited earnings manipulation. The negative correlation between stock return synchronicity and shareholder rights (Morck, Yeung & Yu 2000) is also consistent with Jin & Myers' model.

Corporate disclosure is always partly voluntary. Managers might disclose the bare minimum consistent with a legalistic reading of the regulations or take pains to be transparent. The stocks of US firms with better voluntary disclosure ratings move more independently (Haggard, Martin & Pereira 2008), as do those of Chinese firms with a Big Four auditor (Gul, Kim & Qiu 2010). Ferreira & Laux (2007) find firm-specific return variation correlating positively with corporate governance quality, which they interpret as reflecting investors' power to demand transparency. A similar interpretation explains higher firm-specific return variation in Chinese stocks with more dispersed ownership, more foreign ownership, and less state control (Gul, Kim & Qiu 2010). These studies permit a reinterpretation of the Li et al. (2004), Bae, Bailey & Mao (2006), and Gul, Kim & Qiu (2010) findings of increased asynchronicity after foreign investors enter: More sophisticated investors might demand more disclosure, as well as intensify informed arbitrage.

Transparency especially matters to firms needing public equity (Myers & Majluf 1984), and securities regulations typically require unusually detailed disclosure prior to equity issues. Dasgupta, Gan & Gao (2010) report elevated firm-specific return variation prior to seasoned equity issues (SEOs) and cross-listings, which often precede SEOs, and depressed firm-specific return variation subsequent to these events.

These studies link less synchronous stock returns to higher disclosure quality and to better voluntary disclosure especially. Such findings qualify, but need not contradict, arguments linking informed arbitrage to firm-specific stock return variation. For example, better disclosure might reduce the fixed costs of information generation, which might replace rare large corrections with frequent small ones, more readily observable in any given time window. But, regardless of whether events are discovered by private investors or disclosed publicly, firm-specific return volatility is interpretable as firm-specific return event intensity and reflects firm-specific fundamentals event intensity.

3.3. Insider Trading

Informed arbitrage and public disclosure are not the only ways private information can enter share prices. Manne (1966) argues for unrestricted insider trading because insiders, having the most information about their firm, are best able to engage in informed arbitrage should the firm's stock become mispriced. However, unrestricted insider trading might also worsen information asymmetry problems (Bhattacharya & Nicodano 2001), deterring outsider arbitrageurs from paying for information (Fishman & Hagerty 1992) and leaving the stock less accurately priced.

Firm-specific return variation correlates with the intensity of insider trading in US firm-level data (Piotroski & Roulstone 2004) but also correlates with the strength of restrictions on insider trading across countries (Durnev & Nain 2007). These seemingly discordant results are

reconciled by recalling that US insider trading restrictions do not ban insider trading but require insiders to refrain from trading until material inside information is made public, as well as to disclose their trades. The incidence of disclosed firm-specific events might thus correlate with subsequent insider trades in countries with US-style insider trading rules, but not where insiders freely trade on undisclosed private information.

Consistent with this reconciliation, Khwaja & Mian (2005) report that Pakistani insiders' pump-and-dump trading correlates with elevated stock return synchronicity, perhaps because such practices deter informed arbitrage by outsiders. Fernandes & Ferreira (2009) find a country's first enforcement of its insider trading law elevating firm-specific variation in developed, but not emerging, economies, consistent with insider trading restrictions encouraging fuller disclosure in developed economies, but not where institutions are chronically unreliable. Bhattacharya et al. (2000) argue that, regardless of sporadic enforcement actions, firm-specific information in many low-income economies seeps slowly into stock prices via insider trading well before any public disclosure.

4. FUNCTIONAL EFFICIENCY

The previous section proposes that firm-specific stock return volatility is higher where informed arbitrage is less costly, disclosure fuller, and insider trading regulations more conducive to transparency, all else equal. The findings present a *prima facie* case for elevated firm-specific return volatility, all else equal, reflecting fuller and prompter information capitalization into stock prices. That is, elevated firm-specific return volatility can reflect elevated firm-specific return event intensity.

As conceded above, all else is seldom equal, and the assumption that fundamentals events unfold similarly across firms and over time is excessively strong. Once heterogeneity across firms, or over time for a given firm, is conceded, an instrumental view of informational efficiency comes into focus. Informational efficiency is a means to an end, not necessarily an end per se.

The social purpose of financial markets is arguably to allocate the economy's savings to their highest value uses (Schumpeter 1911). Tobin (1984) defines the stock market as functionally efficient if stock price changes push the economy toward a microeconomically efficient allocation of capital, and he notes that functional and informational efficiency need not coincide. Indeed, Grossman & Stiglitz (1980) and Black (1986) argue they cannot if information is costly. Thus, tests of how closely share prices obey a martingale (Griffin, Kelly & Nardari 2013) need not gauge functional efficiency. For example, a casino stock market, with stock prices set by roulette wheels, might be totally free of momentum effects, mean reversion, or other such deviations from a martingale, yet obviously it generates share prices utterly unrelated to firm fundamentals and utterly useless in allocating capital to its highest value uses.

Such considerations shift our focus from informational efficiency to functional efficiency: Do stock prices that move about more asynchronously better direct capital to its highest value uses? To explore this, Wurgler (2000) gauges the functional efficiency of a country's financial system by the correlation of capital spending with value-added across industries. If a country's capital spending concentrates in its higher value-added industries, capital flows to where it creates more new wealth and Wurgler's measure is near +1. If capital is sprinkled randomly across sectors, without regard to where its return is higher, the measure is near zero. If capital perversely flows disproportionately to where its value-added is lowest, the measure drops to minus one.

Wurgler finds more functional efficiency in the financial systems of economies with higher mean incomes, larger financial sectors, and stronger shareholder rights. Most relevant here, **Figure 3** plots Wurgler's (2000) finding that more asynchronous stock returns correlate with more functionally efficient capital allocation.

Durnev, Morck & Yeung (2004) replicate Wurgler's finding using industry-level US data. Gauging the marginal value of capital by Tobin's marginal Q ratio (one plus the estimated net present value of the firm's marginal capital project over its setup cost, adjusted for taxes), they find higher firm-specific return event intensity in US industries where marginal Q is nearer to one, and thus capital allocation is more functionally efficient. Allocating capital to its highest value uses should ultimately enhance overall total factor productivity (TFP). Consistent with this, Durnev et al. (2004) report higher TFP growth in countries whose stock markets exhibit higher firm-specific return event intensity.

These findings motivate further theoretical and empirical reflection on the functional efficiency of financial markets; its determinants; and its relationship to informational efficiency, often misconstrued as a normative goal. Most importantly, functional efficiency mandates considering firm fundamentals, how these change, and how the stock market's faithfulness in reflecting fundamental values matters to the real economy.

5. FUNDAMENTALS

The previous section takes firm-specific and market-wide fundamentals volatilities as given, and considers how differences in the way stock prices approximate fundamentals might generate the time series and cross-sectional patterns observed in firm-specific and market-wide return volatilities. Morck, Yeung & Yu (2000) find that stocks exhibit higher proportions of firm-specific volatility in countries with higher incomes and fewer corruption problems, but they control for firm-specific fundamentals variation with a potentially problematic measure of earnings volatility. Better fundamentals variation measures better explain the relative importance of firm-specific versus market-wide return volatility in cross-section (Pastor & Veronesi 2003) and panel (Wei & Zhang 2006, Chun et al. 2008, Irvine & Pontiff 2009) data. These findings necessitate considering why firm-specific fundamentals volatility—that is, firm-specific fundamentals event intensity—might vary across firms, industries, countries, and time.

5.1. An Excess of Explanations

Irvine & Pontiff (2009) link elevated firm-specific volatility in fundamentals and returns to increased competition, arguing that smaller momentary leads or missteps induce more protracted gains and losses in the more competitive latter twentieth-century US economy. Supported by larger increases in fundamentals volatility in deregulated industries, this explanation potentially accommodates many other empirical findings. Gaspar & Massa (2006) similarly argue that market power lets firms smooth firm-specific earnings fluctuations to lower information uncertainty for investors on the basis of their finding that firms with larger market shares have lower firm-specific fundamentals and stock return volatilities.

Pastor & Veronesi (2003) find higher firm-specific earnings volatility in younger firms, and Fama & French (2004) report a rising incidence in the late twentieth century of small and newly listed firms, which have lower and more positively skewed earnings. Both suggest that newer firms have more volatile fundamentals and may be subject to more frequent revaluations by investors. Brown & Kapadia (2007) link the time trend in idiosyncratic return volatility to the incidence of initial public offerings (IPOs) and report persistently higher idiosyncratic volatility in later cohorts of IPOs. They conclude that the findings of Fama & French reflect riskier firms getting listed, not smaller firms being riskier. Fink et al. (2010) find a steady drop in firm age at IPO—from ~40 years in the early 1960s to less than 5 years by 2000—and that controls for firm age explain the time trend in US idiosyncratic return volatility.

Several studies relate elevated firm-specific return volatility to better corporate governance. Recall that Ferreira & Laux (2007) find elevated firm-specific return volatility in firms with higher corporate governance scores, and Gul, Kim & Qiu (2010) report higher firm-specific return volatility in Chinese stocks with more dispersed ownership, more foreign ownership, and less state control. If better-governed firms are more apt to pursue promising, but risky, innovative investments (John, Litov & Yeung 2008), these findings might reflect higher firm-specific fundamentals volatility, as well as greater transparency. Also supporting a governance effect, Cheng (2008) finds lower firm-specific fundamentals and stock return variability in firms with larger boards, a widely accepted proxy for poor governance (Yermack 1996; Hermalin & Weisbach 2003; Adams, Hermalin & Weisbach 2010). Malkiel & Xu's (2002) linking institutional investor stakes to elevated firm-specific return volatility can be reinterpreted as institutional investors holding managers to higher governance standards (Shleifer & Vishny 1986). A similar re-interpretation might recast fuller disclosure (Jin & Myers 2006; Haggard, Martin & Pereira 2008; Dasgupta, Gan & Gao 2010) and cross-listing into a regulatory regime enforcing stronger shareholder rights (Fernandes & Ferreira 2008) as improving corporate governance. Adams, Almeida & Ferreira (2005) find elevated stock return volatility in firms controlled by founders and argue that these, like firms with small boards, undertake riskier value-creating investments because they are better governed.

Cross-country differences in corporate governance might also matter. Listed corporations in more corruption-prone economies are more apt to belong to business groups, and thus have equity cross-holdings, shared directors, and/or a common controlling shareholder (La Porta, Lopez-de-Silanes & Shleifer 1999). Firms in business groups exhibit lower firm-specific return volatility in Japan (Hamao, Mei & Xu 2007) and elsewhere (Khanna & Thomas 2009). One possible explanation of this result is that group firms coinsure (Hoshi, Kashyap & Scharfstein 1991) against adverse firm-specific shocks: Temporarily successful group member firms prop up temporarily unsuccessful related firms. Another is that business groups facilitate tunneling and thus insiders' appropriation of abnormal firm-specific profits (Jin & Myers 2006).

Japan, which grants bankers substantial corporate governance influence, is an outlier in **Figure 2**—a high-income economy where firm-specific return volatility is persistently low (Morck & Yeung 2003b) and dropping through the 1990s (Hamao, Mei & Xu 2007). Banker governance influence correlates with Japanese firms pursuing low-risk strategies (Morck, Nakamura & Shivdasani 2000), and firm-specific return volatility is significantly higher in Japanese family-controlled firms (Nguyen 2011).

5.2. Creative Destruction and Firm-Specific Event Intensity

Chun and colleagues (Chun et al. 2008; Chun, Kim & Morck 2011) find that firms in US industries that invest more intensively in information technology (IT) have less synchronous fundamentals and returns, as well as higher productivity growth. **Figure 4** summarizes their findings. Endogenous growth theory (Jovanovic & Rousseau 2005) links IT to a broad wave of creative destruction (Schumpeter 1911) across the US economy in the late twentieth century: The creative firms that most successfully applied IT in their sectors profited hugely, leaving unsuccessful innovators and noninnovative incumbents partially or completely destroyed. Chun, Kim & Morck (2011) argue that elevated firm-specific return and fundamentals volatilities reflect this wave of IT-driven creative destruction magnifying the gap between winners and losers. Consistent with this, Chun, Kim & Morck (2013) find this effect fading in the early twenty-first century as IT investment plateaus across sectors and the IT boom appears to have run its course.

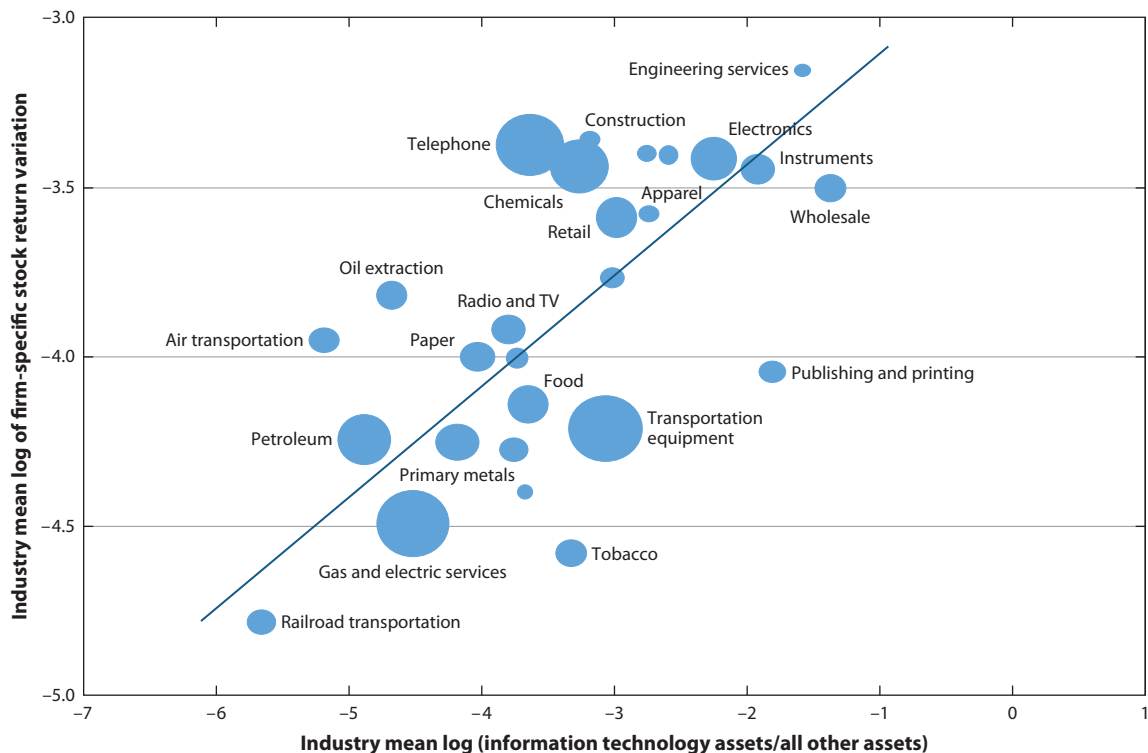


Figure 4

Investment in innovation and firm-specific event intensity. The stocks of firms in US industries with histories of heavier investment in information technology (IT)-related capital assets exhibit higher firm-specific return volatility in the 1990s. Circle sizes reflect relative industry total assets.

Consistent with this explanation, Irvine & Pontiff (2009) link elevated firm-specific volatility in fundamentals and returns to increased competition associated with deregulation. Extensive US deregulation in the 1980s exposed creaking, formerly politically sheltered monopolies (Stigler 1971) to pressure from more innovative entrants: Incumbent firms in long-stable sectors suddenly felt the full force of Schumpeterian creative destruction.

A wave of creative destruction also meshes with the firm age effect reported above (Pastor & Veronesi 2003; Fama & French 2004; Brown & Kapadia 2007; Fink et al. 2010). A wave of newly listed firms is consistent with a wave of creative destruction because the top executives of established firms, whose human capital relates to existing technologies, often block disruptive innovation (Bower & Christensen 1995) and because new firms offer creative entrepreneurs surer ownership of their ideas (Schumpeter 1911). Finally, Chun, Kim & Morck (2013) argue that low returns in listed firms can accompany a wave of creative destruction that increases the overall productivity of the economy if the initial owners of creative firms capture much of the return to innovation prior to their IPOs.

Also consistent with innovation elevating firm-specific volatility, Kothari, Laguerre & Leone (2002) find research and development (R&D) spending positively related to subsequent earnings volatility. Osinga et al. (2011) find advertising spending correlated to elevated firm-specific return volatility in pharmaceutical firms, which could reflect advertising campaigns either having winner-take-all characteristics akin to R&D races or echoing innovative success. Bartram, Brown & Stulz

(2012) report higher idiosyncratic return volatility in US firms than in comparable foreign firms and link the difference to R&D and patents. Brown & Kimbrough (2011) link intangible investments to earnings variability and find R&D especially correlated with earnings variability in industries where patents are better protected.

Building on the real option models of Galai & Masulis (1976) and Myers (1977), Cao, Simin & Zhao (2008) argue that levered firms' managers, to maximize existing shareholders' wealth, favor investments that elevate their firm's idiosyncratic risk. Cao, Simin & Zhao find firm-specific return volatility positively correlated with Tobin's average Q, which they interpret as a proxy for growth options. They further find that controlling for growth options removes, or even reverses, the idiosyncratic volatility trend in Campbell et al. (2001) and renders insignificant other explanatory variables, including profitability (Pastor & Veronesi 2003, Wei & Zhang 2006) and firm age and size (Pastor & Veronesi 2003, Fama & French 2004, Fink et al. 2010). Zhang (2010) analogously links firm-specific return volatility to market-to-book ratios and earnings volatility in industry-level data for the US and nine other high-income countries. Bekaert, Hodrick & Zhang (2012) likewise link firm-specific volatility to market-to-book ratios, business cycle variables, and systematic volatility in G7 country data. To the extent that growth options arise from new technologies, and that Tobin's average Q ratios and market-to-book ratios approximate Tobin's marginal Q ratio (a theoretically motivated measure of growth options), these findings also support elevated firm-specific volatility reflecting technological progress.

5.3. The Importance of Functional Efficiency to Creative Destruction

Perhaps most importantly, this explanation links firm-specific return volatility to both market efficiency and fundamentals volatility. King & Levine (1993) present empirical evidence supporting Schumpeter's (1911) argument that an efficient financial system, especially a functionally efficient stock market, is essential to fast-paced creative destruction. This is because creative potential entrepreneurs often lack adequate personal or family wealth and must raise risk-tolerant capital from others to develop their innovations.

Creative undertakings are uniquely ill-suited for bank loans because they promise huge upside potential but entail substantial downside risk. Because banks receive fixed interest, bankers are unimpressed by upside potential, however huge, but deeply concerned about downside risk. Creative innovators typically have scant collateral, which bankers value highly. Even ultimately successful innovators may not generate substantial revenues for many years; however, bank loans typically require prompt commencement of regular payments of interest and principal.

Schumpeter (1911) argues that creative entrepreneurs therefore need economically efficient financial markets in which to raise capital.⁴ Stock markets are especially helpful (Atje & Jovanovic 1993, Levine & Zervos 1998) because shareholders balance downside risk against upside potential, demand no collateral, and accept that dividends may not begin for many years. Even venture capital firms, financial institutions that provide capital to innovators, typically do so with the expectation of recouping their investment plus a profit when the innovators' firms go public (Gompers & Lerner 2001), and thus also rely on stock markets. Once listed, these firms can grow further by issuing more equity and typically only much later come to rely mainly on retained earnings and debt.

⁴Schumpeter was unimpressed with high finance, viewing highly leveraged banks, his era's mode of financial engineering, as diversions from the financial system's social purpose (Leathers & Raines 2004).

Costly regulations with scant real positive impact on corporate governance render outside equity capital from either an IPO or an SEO more costly. The period from 1975 through 2000 saw a series of sweeping financial liberalizations in the United States and elsewhere that, at first, at least dismantled a broad range of arguably inefficient regulation. Although events after 2000 led many to conclude that deregulation grew excessive, it seems plausible that increasing competition among market makers and brokers (Geisst 2012) and an expanding venture-capital-fund-to-IPO cycle (Gompers & Lerner 2001) improved the informational and functional efficiency of the US financial systems in this era. Similar liberalizations may have had like effects in other countries (Bekaert, Harvey & Lundblad 2005; Henry 2007).

This linkage between functional efficiency and creative destruction can also play out across countries. In countries where corporate governance standards are lower, public equity capital is dearer (La Porta et al. 1998, Rajan & Zingales 1998) and new listings are rarer (La Porta et al. 1998). This leaves entrepreneurs who are intent on founding new firms with public equity capital finding it tough to do so. In such countries, wealthy business families often control vast business groups (Rajan & Zingales 2003, Morck & Yeung 2004), whose member firms' assets are what creative destruction would destroy (Morck & Yeung 2003a). Thus, less firm-specific variation amid business groups (Khanna & Thomas 2009) might reflect sluggish innovation.

Even Japan fits this pattern. Japan's prolonged economic slowdown after 1990 is attributed to stalled innovation (Morck & Yeung 2003b). Risk-averse bank-influenced firms (Morck, Nakamura & Shivdasani 2000) predominate in sheltered backwater sectors, whereas many family firms are actually run by first-generation entrepreneurs, whom business families adopt as legal sons and heirs (Mehrotra et al. 2013). Perhaps higher return comovement for bank-linked than for family firms (Nguyen 2011) reflects more innovation in the latter.

6. NOISE TRADERS AND SYSTEMATIC RISK

Noise in financial markets is doubtless important in understanding event intensity; however, a consensus as to how it does so remains elusive. Thus far, our focus is firm-specific events, but some firm-specific return volatility may well be “occasional frenzy unrelated to concrete information” (Roll 1988, p. 566), and Malkiel & Xu (2002) pursue this interpretation.⁵ We feel the weight of evidence now suggests that much, perhaps most, firm-specific volatility reflects information capitalization but concede that the issue is far from closed.

Market-wide stock market volatility can likewise reflect macroeconomic events (Bernanke & Kuttner 2005, Rigobon & Sack 2008) or noise (Keynes 1936, Kindleberger 1978, Devenow & Welch 1996). Market-wide noise, because it cannot be diversified away, is potentially more economically important to the real economy, and thus to functional efficiency, than firm-specific noise.

Thus, DeLong et al. (1990) presume noise trading to be synchronous—driving the whole market (or at least a broad section of it) to unrealistic heights or depths. Their irrationally overoptimistic noise traders inflate all-equity investments above fundamental values, letting firms issue overvalued shares or, equivalently, lowering their costs of public equity capital. Their irrationally pessimistic noise traders can likewise depress the all-equity investments, deterring firms from issuing public equity.

⁵Rajgopal & Venkatachalam (2011) and Chen, Huang & Jha (2012) link idiosyncratic risk to noise associated with earnings manipulation. Lee & Liu (2011) and Xing & Anderson (2011) argue for a nonlinear relationship between price informativeness and firm-specific return volatility. The hypothesis that greater stock return variability reflects stock prices less accurately tracking changes in fundamental value deserves further consideration.

Noise traders can affect the economics of the informed arbitrage business in (at least) two ways. First, Black (1986) argues that noise traders' irrational optimism or pessimism can push stock prices away from fundamental values, thereby making informed risk arbitrage more profitable. Second, DeLong et al. (1990, p. 712) argue that noise traders can "create their own space" in the stock market because their shifting optimism and pessimism affect all stock prices synchronously. This elevates systematic risk, which raises the cost of capital for everyone, including informed arbitrageurs. If higher capital costs drive enough informed arbitrageurs out of business, stock markets are left to noise traders, and informational efficiency is compromised.

These two effects conflict when noise traders are irrationally optimistic. Irrationally exuberant share prices cheapen equity capital, which theoretically cuts costs for both informed arbitrageurs and creative innovators. But heightened systematic risk makes equity dearer, raising costs of capital for both. Which effect dominates is unclear a priori, though historical evidence suggests that noise trader optimism often correlates with cheap equity capital (Keynes 1936, Kindleberger 1978, Shiller 2000, Reinhart & Rogoff 2011). If noise trader optimism does cut costs of capital, Schumpeter's (1911) thesis that creative entrepreneurs lacking substantial private wealth require efficient stock markets can be extended. Perhaps optimistic noise traders, by lowering new entrepreneurial firms' cost of equity, accelerate creative destruction, thereby elevating firm-specific event intensity. Alternatively, a cost of capital biased down by noise traders might cause substantial capital misallocation and hobble long-term growth.

When noise traders are pessimistic, in contrast, the Black (1986) and DeLong et al. (1990) effects align. Irrationally dejected share prices and amplified systematic risk inflict a double whammy on the cost of capital, starving both informed arbitrageurs and creative entrepreneurs of capital. The latter attenuates the intensity of firm-specific fundamentals events, and the former renders stock prices less faithful reflections of such events. Pessimistic noise traders might thus make capital dearer to new entrepreneurial firms, retarding creative destruction, and to informed arbitrageurs, retarding information capitalization. Either effect could then decrease firm-specific event intensity. But working in the other direction, arbitraging undervalued stocks entails taking long positions, a less costly arbitrage strategy than shorting overvalued stocks in an irrationally exuberant stock market.

Much of the evidence above can be cast as consistent with noise traders affecting asset prices. The elevated systematic risk and depressed firm-specific risk evident in very low-income countries' stocks (Morck, Yeung & Yu 2000, Jin & Myers 2006) are consistent with noise traders predominating, though more erratic government policy might also be to blame (Taylor 2000, Blanchard & Simon 2001). The heightened correlation across asset prices in bear markets (Ribeiro & Veronesi 2002; Brockman, Liebenberg & Schutte 2010), especially evident in low-income countries (Brockman, Liebenberg & Schutte 2010), also dovetails with pessimistic noise traders pushing equity prices down and thereby elevating both leverage and systematic risk, though other explanations associated with fixed information costs (Veldkamp 2006) may also be important.

How the limits to arbitrage (Shleifer & Vishny 1997) affect return event intensity is obviously a complicated business, and a full review is beyond the scope of this article. However, the evidence above of connections to functional efficiency gives the problem very general interest. Further theoretical and empirical research exploring these connections would be useful.

7. CONCLUSIONS

In a perfectly informationally efficient financial market, firm-specific return volatility reflects the intensity of underlying firm-specific events (French & Roll 1986). We call this firm-specific fundamentals event intensity. If informational efficiency is imperfect, firm-specific return volatility reflects

the capitalization into stock prices of some, but perhaps not all, previously private information about firm-specific fundamentals events. We call this firm-specific stock return event intensity.

A stream of empirical work links firm-specific return event intensity to plausible indicators of the extent of informed arbitrage: easier short selling, hedge fund interest, openness to foreign investors, investor rights, etc. Another line of work suggests a link to public announcements: news items and public disclosure documents. Both lines of work are credible and suggest higher return event intensity when stock prices echo firm-specific fundamentals events more faithfully. A range of empirical and theoretical arguments can be reconciled to this thesis, including many that a priori seem discordant.

One important cause of events that alter firm-specific fundamental values is creative destruction, in which creative winner firms' valuations rise, and loser firms' valuations are destroyed, at least partially. Higher firm-specific fundamentals event intensity can reflect more vigorous technological progress, as in the late-twentieth-century IT boom in the United States, or in more innovative US industries, or in higher-income economies whose prosperity depends more heavily on creative destruction.

Causality here is likely neither unidirectional nor straightforward. First, creative destruction feeds back upon itself. More intensive creative destruction shortens the profitable product life of an innovation. If this encourages successful entrepreneurs to move on to new innovations faster, fast creative destruction can encourage yet more creative destruction. But, if the faster evaporation of an innovation's profits deters further innovation, a negative feedback results instead. How fundamentals event intensity feeds back upon itself is thus ambiguous.

A larger feedback loop connects firm-specific fundamentals event intensity, firm-specific return event intensity, functional efficiency, and creative destruction. More and larger firm-specific fundamentals events increase the value of having information the market does not yet have, and thus increases appropriately informed arbitrageurs' profits. But, more firm-specific fundamentals volatility also elevates the risk arbitrageurs incur taking large undiversified positions in stocks they deem mispriced (Shleifer & Vishny 1997). How this risk-return trade-off affects the intensity of informed arbitrage is ambiguous. If the trade-off is such that intensified creative destruction, by elevating firm-specific fundamentals event intensity, encourages informed arbitrage, the stock market might become more informationally and functionally efficient. Capital could then flow more reliably to more promising entrepreneurs, further accelerating creative destruction. But, if the elevated firm-specific fundamentals event intensity instead discourages arbitrage, the stock market might become less informationally and functionally efficient, and capital would flow less reliably to promising entrepreneurs, retarding creative destruction. Because noise trader herding can also affect the cost of capital to informed arbitrageurs and potentially creative entrepreneurs alike, yet another set of feedback effects arise.

Institutions, especially those that encourage or discourage private information generation, informed arbitrage, innovation, and financial development more generally, may be important because they affect which of these many possible feedback effects dominate. Additional empirical and theoretical work to elaborate, qualify, or refute these hypotheses is welcome.

DISCLOSURE STATEMENT

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