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Domestic and Foreign Earnings, Stock Return Variability, and the Impact of Investor Sophistication

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ABSTRACT

We examine the importance of foreign earnings relative to domestic earnings for a sample of U.S. multinationals using variance decomposition. Our methodology represents an alternative and complementary approach over the prior literature, which is based on traditional regressions and earnings response coefficients. We document that domestic earnings are more important in explaining the variance of unexpected returns than are foreign earnings and that the relative importance of domestic earnings is a decreasing function of investor sophistication. Last, we classify institutional investors as either short- or long-term oriented following Bushee [1998]. We find that the variance contribution of foreign earnings increases with the level of investment

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by long-term investors. In contrast, there is no significant relation between the degree of ownership by short-term (or transient) investors and the variance contribution of domestic and foreign earnings. Overall, our results are consistent with Thomas's [1999] finding that investors on average underestimate the persistence of foreign earnings.

1. Introduction

We examine the importance of foreign earnings relative to domestic earnings for a sample of U.S. multinationals. In particular, we investigate the ability of domestic and foreign earnings to explain the variance of unexpected stock returns. Several studies examine the value relevance of foreign earnings relative to domestic earnings but document contradictory results. Whereas Bodnar and Weintrop [1997] and Bodnar, Tang, and Weintrop [1999] find that investors value foreign earnings significantly more than domestic earnings, Denis, Denis, and Yost [2002] and Christophe and Pfeiffer [2002] obtain opposite results.[1]

We contribute to the literature in several respects. First, we extend the variance decomposition methodology of Campbell [1991], Campbell and Ammer [1993], Vuolteenaho [2002], and Callen and Segal [2004] to evaluate and compare the variance contribution of domestic and foreign earnings. We measure variance contribution by the impact of each component of earnings on the variability of unexpected stock returns. Prior studies make inferences based on the magnitude of the domestic and foreign coefficients in a regression of stock returns on these components of earnings (i.e., they focus on earnings response coefficients (ERCs)). Differences in coefficient magnitudes, however, present only one dimension of the difference in the importance of earnings components. Even if one earnings component has a larger coefficient, if the earnings component varies modestly, that earnings component will only have a minor ability to explain returns.

The variance decomposition methodology has two main features: (1) it incorporates an expectations model for foreign and domestic earnings to guide the empirical tests, and (2) it explicitly controls for changes in expected returns over time. Regarding the first feature, by having an expectations model, our earnings variables more precisely measure the true earnings news. The second feature is important because Campbell, Lo, and MacKinlay [1997, p. 265], show, among others, that small changes in expected discount rates can have a large impact on security returns, especially when expected returns are persistent.[2]

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[1] In general, there are varied arguments to support different prices of foreign and domestic earnings. These arguments are related (but not limited) to differences in risks and growth opportunities across domestic and foreign markets, economies of scale and synergy, institutional factors, investor preferences, market mispricing, agency costs of monitoring managers, and suboptimal cross-subsidization (e.g., see Denis, Denis, and Yost [2002], Christophe [2002]).

[2] The need to incorporate time-varying discount rates in accounting valuation models is also emphasized by Beaver [1999, p. 37], who states, "Thirty plus years ago, Miller and Modigliani (1960) spent considerable effort to estimate the cost of capital for one industry for three years.

Second, we consider the role sophisticated investors play in assessing the importance of earnings components. Not all investors have the same insight into the firm or the same tools to analyze the differential earnings streams with respect to variability and persistence. As we show later, variance contribution is a function of both the persistence of the earnings component *and* its variability.[3] Although researchers recently show considerable interest in the role of investor sophistication (e.g., Bonner, Walther, and Young [2003], Bartov, Radakrishnan, and Krinsky [2000]), prior research does not examine the impact of investor sophistication on the valuation of domestic versus foreign earnings. If it is more difficult to analyze foreign earnings because either there is less public information or it is more difficult information to analyze, as Thomas [1999] suggests, then sophisticated investors, with their greater ability to collect private information or to process difficult public information, will be better able to price foreign earnings. Third, our sample is more extensive and covers a longer period than prior studies, which allows for more robust conclusions.

A summary of our findings is as follows. We find that both domestic and foreign earnings contribute significantly to explaining unexpected stock return variability. In addition, the variance contribution of expected-return news is also significant, suggesting that it is important to control for changes in expected future discount rates. Directly related to our research question, we document that domestic earnings have significantly greater impact on unexpected return variability than do foreign earnings. As the relative variance contribution could be contextual and related to firm-specific factors, we test whether this result is robust to alternative explanations. In particular, we consider firm size, growth opportunities, the ratio of foreign earnings to total earnings, the sign of earnings and earnings changes, income taxes, and foreign exchange rate effects. None of these alternatives materially affects this result.

Using two-stage least squares (2SLS) tests that control for the endogeneity of institutional ownership, we find evidence suggesting that sophisticated investors assess the importance of domestic versus foreign earnings differently from other investors. In particular, as investor sophistication increases, the relative variance contribution of foreign earnings increases, although domestic earnings remain more important across all levels of investor sophistication. This finding is consistent with sophisticated investors being better equipped to analyze the often scant publicly available information about a firm's foreign operations and their being able to access information on these operations that less sophisticated investors are unable to obtain.

Finally, we document that institutional investors with a long-term investment approach evaluate domestic versus foreign earnings differently from

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It is remarkable that the assumption of a constant [discount rate] across firms and time is the best we can do."

[3] We explain further the variance decomposition methodology and its relation to the ERC measure used in the value-relevance literature in section 3.

institutions with a short-term approach. Specifically, employing the classifications of Bushee [1998], we find that the variance contribution of foreign earnings increases with the level of investment by long-term investors. In contrast, there is no significant relation between the degree of short-term (or transient) investors and the variance contribution of domestic and foreign earnings.

The rest of the article is organized as follows. Section 2 reviews the literature on domestic versus foreign earnings and sophisticated investors and presents our research hypotheses. Section 3 describes the variance decomposition model used to assess the importance (or variance contribution) of domestic and foreign earnings. Section 4 discusses the data and sample selection. Section 5 presents the major empirical results and the sensitivity analyses. Section 6 concludes.

2. *Background and Hypotheses*

This section reviews the literature on foreign and domestic earnings and develops our hypotheses regarding the relative pricing of foreign and domestic earnings, including the role that sophisticated investors play in the process.

2.1 FOREIGN VERSUS DOMESTIC EARNINGS

In an early study, Boatsman, Behn, and Patz [1993] examine whether equity valuations of U.S. multinationals are affected by geographical segment income disclosures mandated by Statement of Financial Accounting Standard (SFAS) No. 14. The authors conclude that there is little evidence that geographical segment income disclosures affect equity values. In a similar and more recent study, Christophe and Pfeiffer [2002] find that the level of domestic sales revenues is positively associated with Tobin's q, whereas the level of foreign sales is not. In an alternative specification, they find that the estimated coefficient on changes in domestic sales is marginally greater than the coefficient on foreign sales changes. Christophe and Pfeiffer conclude that investors do not value international operations as highly as domestic operations.

Bodnar and Weintrop [1997] partition earnings into domestic and foreign components and test whether these components differentially explain annual excess stock returns. They document that the coefficients on foreign and domestic earnings changes are both positive and significantly different from zero and that the coefficient on foreign earnings is significantly larger than the coefficient on domestic earnings. They also find that the incremental impact of foreign earnings is positive when foreign sales growth exceeds domestic sales growth. These results suggest that the larger coefficient on foreign earnings is evidence of greater growth opportunities for foreign than for domestic operations.[4]

[4] In a follow-up study, Bodnar, Hwang, and Weintrop [2003] find similar results for firms domiciled in Australia, Canada, and the United Kingdom.

Christophe [2002] replicates Bodnar and Weintrop [1997] and finds similar results. However, upon splitting the sample into observations with positive and negative earnings changes, he observes that although investors do not value domestic and foreign earnings changes differently for positive earnings changes, the estimated coefficient on foreign earnings changes is significantly larger than the estimated coefficient on domestic earnings changes when earnings changes are negative. Based on these findings, Christophe concludes that investors do not value foreign operations as highly as domestic operations.

Denis, Denis, and Yost [2002] compare the effects of geographical and industrial diversification on firm value. Although they show an increase in the extent of geographical diversification by firms over time, geographical diversification is associated with a reduction in firm value.[5] They conclude that the costs of global diversification outweigh the benefits.[6] In contrast, Bodnar, Tang, and Weintrop [1999], using a methodology similar to Denis, Denis, and Yost, find that global diversification is associated with higher firm value.

Based on the preceding discussion and the contradictory findings, our first hypothesis (stated in alternative form) is nondirectional and investigates the relative variance contribution of domestic and foreign earnings:

H1: The variance contribution of foreign earnings to unexpected returns differs from that of domestic earnings.

2.2 THE ROLE OF INVESTOR SOPHISTICATION

The first hypothesis investigates the *average* effect of domestic and foreign earnings on unexpected stock returns. In this section, we examine whether the relative variance contribution of domestic versus foreign earnings is a function of the degree of investor sophistication.

There are several reasons why more sophisticated investors may place different values on foreign versus domestic earnings. In general, prior research documents that sophisticated investors behave differently from other, less informed investors. Findings in the psychology and accounting literatures indicate that more experienced individuals have more appropriate cue weights (e.g., Slovic [1969], Bonner, Walther, and Young [2003]). Sophisticated investors have superior abilities and consequently can learn better from experience (Bonner and Walker [1994]). Economic incentives are potentially important as well. Institutional investors have large investment portfolios and therefore have much more to gain or lose in absolute dollar terms from their investment decisions. Furthermore, the costs of engaging in in-depth firm analysis are lower for institutions, in part because of

[5] This result holds also after controlling for the endogeneity of the diversification decision.

[6] Consistent with Denis, Denis, and Yost [2002], Click and Harrison [2000] document that multinationals have disproportionally high levels of assets in relation to the earnings they generate and that foreign assets in particular are associated with value destruction.

their superior access to databases and analytical tools (Bonner, Walther, and Young [2003]).

Many studies report results that are consistent with a superior ability of sophisticated investors to gather, analyze, and price information. Price [1998] finds that informed investors appear to make greater use of accounting disclosures and nonearnings information to form more precise earnings expectations. Bonner, Walther, and Young [2003] document that sophisticated investors incorporate the information inherent in the relative accuracy of analyst forecasts to a greater extent than less informed investors. In addition, Bhattacharya et al. [2003] provide evidence that sophisticated investors demonstrate less behavioral bias in the way they process pro forma earnings information relative to more sophisticated investors. Finally, the efficiency of a firm's stock price is associated with the degree of sophistication of the firm's marginal investor (e.g., Walther [1997], Bartov, Radakrishnan, and Krinsky [2000], Jiambalvo, Rajgopal, and Venkatachalam [2002], Battalio and Mendenhall [2003]).[7]

More directly related to our study, Thomas [1999] shows that foreign earnings tend to be more persistent than domestic earnings and that, on average, investors underestimate the persistence of foreign earnings.[8] This finding is consistent with investors not understanding (or not trusting) foreign earnings. Thomas posits that one possible explanation for the existence of market mispricing is that it is difficult for investors to understand fully the origin of firms' foreign earnings (Thomas [1999, p. 265]).[9] Such an explanation seems plausible given the relative paucity of information on foreign operations provided by many firms (e.g., White, Sondhi, and Fried [2003, p. 577]).[10] If the average investor finds it difficult to evaluate the foreign component of earnings, more sophisticated investors should be in a better position to make such evaluations. Ke and Petroni [2003] suggest that the

[7] Bhattacharya et al. [2003] define sophisticated investors as "large investors" based on the dollar value of shares traded. Hence, their results are not directly comparable to other studies that use institutional holdings based on filings required by section 13(f) of the Securities and Exchange Act as a proxy for investor sophistication. Battalio and Mendenhall [2003] use both trade size and percentage shareholding by institutions as proxies for sophistication. They show that small trade size is significantly and negatively correlated with the fraction of the firm's shares held by institutions.

[8] Thomas [1999] develops a trading strategy using publicly available data about the foreign component of total earnings that earns abnormal returns.

[9] In a subsequent study, Thomas [2004] hypothesizes that his 1999 result should be less pronounced for firms that are followed by more sophisticated investors. Based on factors that previous research finds to be associated with institutional investors, he finds that the foreign earnings anomaly is decreasing in firm size, the market-to-book ratio, and return on equity. By focusing directly on institutional holdings, our study complements Thomas [2004] and provides a more direct test of the effect of investor sophistication.

[10] Khurana, Pereira, and Raman [2003] find that financial analysts distinguish between foreign and domestic earnings. However, analysts fail to *fully* incorporate the higher persistence of foreign earnings. They argue that their findings help explain the market mispricing documented by Thomas [1999].

informational advantage of institutions stems both from direct communication with management and from their ability to process publicly available information in a sophisticated manner. Similarly, Bradshaw, Bushee, and Miller [2004] argue that institutions, as sophisticated investors, are the class of U.S. investors most likely to base their investment decisions on detailed financial analysis.

Another potential reason why sophisticated investors assess foreign earnings differently from domestic earnings is related to the home bias literature. Home bias refers to the finding that although theory suggests that investors should hold the world market portfolio of risky assets, in practice the proportion of foreign assets in investors' portfolios tends to be very small (e.g., Ahearne, Griever, and Warnock [2004]). Although direct barriers to international investments may be an important constraint for portfolio diversification, Ahearne, Griever, and Warnock [2004] show that information asymmetries related to poor quality financial information are a more important explanation.[11] Consistent with Ahearne, Griever, and Warnock [2004], Bradshaw, Bushee, and Miller [2004] document that non-U.S. firms with accounting methods that conform highly with U.S. generally accepted accounting principles (GAAP) have greater levels of U.S. institutional ownership. Similarly, Grinblatt and Keloharju [2001] document that distance, language, and cultural biases in making investment decisions are less prevalent among sophisticated investors. However, institutional investors face legal constraints on how much of their portfolios they can invest in foreign stocks. An alternative to investing in foreign securities is to invest in domestic multinational companies. By investing in U.S. multinationals, investors have the advantage of U.S. GAAP, which are both better understood by U.S. investors and possibly of higher quality than other accounting standards (e.g., Ashbaugh [2001]).

Based on the preceding literature review, sophisticated investors are likely to evaluate the variability and persistence of foreign versus domestic earnings differently from other investors. This leads to our second hypothesis (stated in the alternative):

H2: The variance contributions of foreign versus domestic earnings to unexpected returns are a function of the degree of investor sophistication.

2.3 SHORT-TERM VERSUS LONG-TERM INSTITUTIONAL INVESTORS

Recent research documents the existence of distinct groups among institutions that differ in their objectives and information needs. Bushee [1998] classifies institutions into three groups—transient, dedicated, and quasi-indexers—based on factors such as portfolio turnover, diversification, and

[11] Other informational issues relate to lack of knowledge that the firm exists and an inability to monitor the firm (e.g., Kang and Stulz [1997], Bradshaw, Bushee, and Miller [2004]).

momentum trading. Transient institutions have high portfolio turnover and highly diversified portfolio holdings (Bushee [2001]). They focus on the short term and make investments based on the likelihood of short-term trading profits. According to Bushee [2001, p. 214], the short investment horizons of transient investors create little incentive for them to gather information relevant to long-run value.

In contrast, dedicated investors and quasi-indexers focus on the long term and provide stable ownership to firms. Dedicated investors hold large stakes in a limited number of firms. Such ownership creates incentives to invest in monitoring management and to rely on information beyond current earnings to assess managers' performance. Quasi-indexers generally follow indexing and buy-and-hold strategies, and are characterized by high diversification. Although quasi-indexers follow a passive investment strategy, these investors also have strong incentives to monitor management to ensure that it is acting in the best interest of the firm (Monks and Minow [1995]). In general, long-term investors have better access to private information about their portfolio firms (Porter [1992]). Given the divergence in objectives and information needs, our third hypothesis (stated in the alternative) examines whether the level of ownership by short-term (or transient) investors has different implications for the relative assessment of foreign earnings than ownership by long-term investors (dedicated and quasi-indexers):

H3: The difference between the variance contributions of domestic and foreign earnings to unexpected returns is related (not related) to the level of investment by long-term (short-term) institutional investors.

3. Variance Decomposition Methodology and the Valuation Model

This section first explains the variance decomposition methodology and contrasts it with the traditional methodologies used in value relevance studies. We then describe the valuation model and the estimation of the variance contribution of domestic and foreign earnings.

3.1 VARIANCE DECOMPOSITION

The variance decomposition methodology measures the contribution of foreign and domestic earnings and expected future discount rates to the variance of unexpected returns. Therefore, the contribution of each earnings component to the total variance of unexpected returns divided by the latter is essentially the R^2 of that component.

Assuming for simplicity that the variance of each earnings component is intertemporally constant, appendix A shows, in the context of a simple model, that the relative effect of domestic earnings versus foreign earnings in driving security returns depends on *both* the relative variances of domestic and foreign earnings *and* the relative persistence levels of domestic and

foreign earnings.[12] Specifically, the impact of the variance contribution of domestic and foreign earnings on the variability of unexpected returns is captured by the discounted domestic and foreign earnings variances, where the discount rate is a function of the persistence levels of domestic and foreign earnings, respectively.

Variance decomposition and value relevance (ERCs) are complementary. Specifically, the overall relation between unexpected returns and the foreign and domestic earnings components depends on the sensitivity of the return to each earnings component (the ERCs) *as well as* to the variability of each earnings component. To see this, suppose that the covariance between unexpected returns and foreign earnings is 0.2, the covariance between unexpected returns and domestic earnings is 0.6, the variance of foreign earnings is 0.1, and the variance of domestic earnings is 0.4. Assume for simplicity that foreign and domestic earnings are uncorrelated. A regression of unexpected returns on foreign and domestic earnings components will yield ERCs of 2 and 1.5, respectively. The ERC of foreign earnings is greater than the ERC of domestic earnings because foreign earnings are more persistent (persistence parameter = 0.5) than domestic earnings (persistence parameter = 0.33).[13] Thus, in the standard parlance of accounting research, foreign earnings are more value relevant than domestic earnings. Holding all else constant (including the variances of domestic and foreign earnings), a 1% shock to domestic earnings yields a change in returns of only 1.5% whereas a 1% shock to foreign earnings yields a change in returns of 2%. But this is only part of the story in explaining returns. What if foreign earnings shocks are infrequent relative to domestic earnings shocks or do not occur at all? Then no matter how sensitive returns are to foreign earnings, foreign earnings will not drive stock returns. Indeed, in this example, domestic earnings are four times more volatile than foreign earnings; as a consequence, any change in returns is more likely to be driven by domestic earnings than by foreign earnings even though returns are 33% more sensitive to foreign earnings shocks than domestic earnings shocks. From a variance decomposition perspective, the variance contribution of domestic (foreign) earnings to unexpected returns is 0.8 (0.3) (see equation (A9) in appendix A). Hence, the variance contribution of domestic earnings is 2.7 times the variance contribution of foreign earnings. In short, value relevance involves both variance effects and mean effects. ERCs and variance decompositions are *complementary* pieces of information. One cannot understand

[12] This model illustrates the relationship between the ERC and the variance contribution measures in a more simplified environment than the vector autoregressive (VAR) environment that we use empirically. Unlike the VAR, this simple time-series model does not account for variables other than earnings and, moreover, does not cover all aspects of the earnings process.

[13] From equation (A7) in appendix A, the persistence parameter can be computed as (1 − 1/ERC).

the distribution of returns by focusing merely on the mean of the distribution. The variance matters as well.[14]

3.2 THE MODEL

Campbell and Shiller [1988a, b] show that a firm's current unexpected returns can be expressed as a log-linear function of unexpected changes in future expected dividends and unexpected changes in future expected returns (discount rates).[15]

$$r_t - E_{t-1}(r_t) = \Delta E_t \sum_{j=0}^{\infty} \rho^j \Delta d_{t+j} - \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j}, \tag{1}$$

where:

$\Delta =$ first differencing operator
$E_t =$ expectations operator and $\Delta E_t = E_t(\cdot) - E_{t-1}(\cdot)$
$r_t =$ log equity return (cum dividend) in excess of the risk free rate
$d_t =$ log dividends at time t
$\rho =$ constant error approximation term

Vuolteenaho [2002] extends Campbell and Shiller's [1988a, b] model by incorporating the accounting clean surplus relation into the model, thereby replacing dividends with net income.[16] The resulting model takes the form:

$$r_t - E_{t-1}(r_t) = \Delta E_t \sum_{j=0}^{\infty} \rho^j (roe_{t+j} - i_{t+j}) - \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j}, \tag{2}$$

where:

$roe_t =$ log book return on equity in period $t = \log(1 + X_t/BV_{t-1})$
$BV_t =$ book value of equity at time t
$X_t =$ net income in period t
$i_t =$ log of 1 plus the risk free rate in period t

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[14] Some of the accounting literature assumes that there is an inverse functional relationship between the variance of earnings and persistence—namely, the greater the variance of earnings, the more transitory the earnings and hence the lower the persistence. We are agnostic about this issue and let the data determine the relation (in our VAR analysis). Conceptually, the variance of each earnings component and its persistence are distinct concepts although they may be functionally related (see our simple model in appendix A). A related issue concerns the information content of earnings. If earnings are a signal of firm value, higher variance earnings (less precision) should yield lower returns. This is essentially the ERC argument that higher variances reduce the ERC (as in the example in the text). It is correct as far as mean return effects are concerned but it tells us little about the effect of the earnings component on the return variance. On the contrary, the higher the variance of the earnings component, the greater is its contribution to the return variance.

[15] Small case letters denote the logs of the capitalized variables. We abstract from any additive error approximation terms when describing the models.

[16] This extension is *not* obtained by simply substituting for dividends in equation (1) using the clean surplus relation. Rather, it follows from the dynamics of the book-to-market ratio (see appendix B).

These models are derived formally in appendix B. Using the log approximation ($\ln(1 + X) \approx X$), we decompose the (log) return on equity in equation (2) into domestic earnings and foreign earnings scaled by book value of equity, denoted *DEARN* and *FEARN*, respectively. Specifically,

$$\begin{aligned} roe_t &= \log(1 + X_t/BV_{t-1}) \\ &\approx X_t/BV_{t-1} \\ &= DX_t/BV_{t-1} + FX_t/BV_{t-1} \\ &= DEARN_t + FEARN_t, \end{aligned} \tag{3}$$

where DX_t is net income from domestic operations and FX_t is net income from foreign operations. Substituting equation (3) into equation (2) yields the following valuation equation:[17]

$$\begin{aligned} r_t - E_{t-1}(r_t) = \Delta E_t \sum_{j=0}^{\infty} \rho^j (DEARN_{t+j} - i_{t+j}) \\ + \Delta E_t \sum_{j=0}^{\infty} \rho^j FEARN_{t+j} - \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j}. \end{aligned} \tag{4}$$

Defining the unexpected stock return components as expected-return news (nr), domestic earnings news (nD), and foreign earnings news (nF), equation (4) can be expressed as:

$$r_t - E_{t-1}(r_t) = nD_t + nF_t - nr_t, \tag{5}$$

where:

$$nr_t = \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j} \tag{6}$$

$$nD_t = \Delta E_t \sum_{j=0}^{\infty} \rho^j (DEARN_{t+j} - i_{t+j}) \tag{7}$$

$$nF_t = \Delta E_t \sum_{j=0}^{\infty} \rho^j FEARN_{t+j} \tag{8}$$

Equation (5) shows that the unexpected change in current stock returns increases with domestic and foreign earnings news and decreases with expected-return news. An unanticipated increase in the firm's expected domestic or foreign earnings conveys positive information about the firm's prospects and hence translates into higher returns. Conversely, an unexpected increase in future expected returns due to higher risk, for example, translates into negative unexpected current returns.

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[17] In equation (4), i_t is subtracted from *DEARN*. Subtracting it from *FEARN* instead does not change the results.

Taking variances of both sides of equation (5) yields our variance decomposition of the unexpected change in returns.

$$\begin{aligned}\text{var}\{r_t - E_{t-1}(r_t)\} = \text{var}(nr_t) + \text{var}(nD_t) + \text{var}(nF_t) \\ -2\text{cov}(nr_t, nD_t) - 2\text{cov}(nr_t, nF_t) + 2\text{cov}(nD_t, nF_t). \quad (9)\end{aligned}$$

Equation (9) is used to assess the relative impact of domestic and foreign earnings news and expected-return news in explaining equity returns. The greater the variance (or covariance) of any factor(s) on the right-hand side of the equation, the more power that factor has in explaining unexpected returns. Variance contribution is measured by the contribution of each factor—*nD*, *nF*, *nr*—to the variance of stock returns.

3.3 ESTIMATION

The return variance decomposition (equation (9)) cannot be implemented inter alia without estimates (of the dynamics) of future expected returns and the future expected values of the two earnings components. Following Campbell [1991], Campbell and Ammer [1993], Vuolteenaho [2002], and Callen and Segal [2004], we implement the variance decomposition using a log-linear VAR model. In general, VAR estimation is facilitated by assuming that the dynamics of the data are well described by a (stationary) time-series model. Specifically, define z_{it} to be a vector of firm-specific state variables that follows the vector autoregressive process:

$$z_{i,t} = \mathbf{A}z_{i,t-1} + \eta_{i,t}. \quad (10)$$

Consistent with Vuolteenaho [2002] and Callen and Segal [2004], the VAR coefficient matrix **A** is assumed to be constant over time and over firms. The error terms $\eta_{i,t}$ are vectors of shocks and are assumed to have a variance-covariance matrix Ω and to be independent of everything known at $t-1$.

We estimate both a parsimonious short VAR and a richer long VAR specification. The state variables consist of log stock returns, domestic earnings scaled by book value of equity, foreign earnings scaled by book value of equity, and log book-to-market ratio.[18] The short (long) VAR includes one (two) lag(s) for each of the state variables. The short VAR can be described as a system of (mean-adjusted) equations:

$$r_t = \alpha_1 r_{t-1} + \alpha_2 DEARN_{t-1} + \alpha_3 FEARN_{t-1} + \alpha_4 bm_{t-1} + \eta_{1t} \quad (11a)$$

$$DEARN_t = \beta_1 r_{t-1} + \beta_2 DEARN_{t-1} + \beta_3 FEARN_{t-1} + \beta_4 bm_{t-1} + \eta_{2t} \quad (11b)$$

$$FEARN_t = \gamma_1 r_{t-1} + \gamma_2 DEARN_{t-1} + \gamma_3 FEARN_{t-1} + \gamma_4 bm_{t-1} + \eta_{3t} \quad (11c)$$

$$bm_t = \delta_1 r_{t-1} + \delta_2 DEARN_{t-1} + \delta_3 FEARN_{t-1} + \delta_4 bm_{t-1} + \eta_{4t}. \quad (11d)$$

[18] The book-to-market ratio is included in the parsimonious VAR because our model is generated from this ratio (see appendix B). Vuolteenaho [2002] similarly includes the book-to-market ratio in his VAR specifications.

We estimate the regressions using fixed-effects panel data to account for the temporal correlation across observations and to maintain the heterogeneity of the sample firms.[19]

As shown by Campbell (1991), the variance decomposition of these valuation models can be implemented empirically by combining the residuals from the VAR estimation with the unexpected current return valuation equation (equation (4)). Formally, let $ei' = (0, \ldots, 1, \ldots, 0)$, where the 1 is in the ith position. The unexpected change in returns is computed as:

$$r_t - E_{t-1}(r_t) = e1'\eta_{1t}. \tag{12}$$

Equation (10) implies that forecasts of the state vector $z_{i,t}$ can be computed as:

$$E_t[z_{i,t+1+j}] = A^{j+1}z_{i,t}. \tag{13}$$

Using equation (13), the revision in expected future returns (expected-return news) is computed as:

$$\begin{aligned}\Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j} &\equiv E_t \sum_{j=1}^{\infty} \rho^j r_{t+j} - E_{t-1} \sum_{j=1}^{\infty} \rho^j r_{t+j} \\ &= e1' \sum_{j=1}^{\infty} \rho^j A^j \eta_{1,t} = e1'\rho A(I - \rho A)^{-1}\eta_{i,t} = \lambda_1 \eta_{i,t}. \end{aligned} \tag{14}$$

Similarly, the revision in expected future domestic earnings (domestic earnings news) is computed as:

$$\begin{aligned}\Delta E_t \sum_{j=0}^{\infty} \rho^j (DEARN_{t+j} - i_t) &\equiv E_t \sum_{j=0}^{\infty} \rho^j (DEARN_{t+j} - i_t) \\ &\quad - E_{t-1} \sum_{j=0}^{\infty} \rho^j (DEARN_{t+j} - i_t) \\ &= e2'(I - \rho A)^{-1}\eta_{i,t} = \lambda_2 \eta_{i,t}. \end{aligned} \tag{15}$$

where DEARN in equations (11a)–(11d) is defined net of the log of one plus the risk-free rate. From equations (4), (12), (14), and (15) the revision in expected future foreign earnings (foreign earnings news) is computed (residually) as:

$$\begin{aligned}\Delta E_t \sum_{j=0}^{\infty} \rho^j (FEARN_{t+j}) &\equiv r_t - E_{t-1} r_t - \Delta E_t \sum_{j=0}^{\infty} \rho^j (DEARN_{t+j} - i_t) \\ &\quad + \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j} \\ &= (e1' - e2')(I - \rho A)^{-1}\eta_{i,t} = \lambda_3 \eta_{i,t}. \end{aligned} \tag{16}$$

[19] An alternative estimation method is weighted least squares where the weight in each cross-section is the number of firms in the corresponding year to account for the different number of observations in each cross-section (year). To account for possible cross-sectional correlation, the Shao-Rao [1993] jackknife method is used to obtain consistent robust standard errors. The results obtained using this alternative estimation method are similar to the results reported.

The variances and covariances of the variance decomposition (equation (9)) are obtained from the estimated variance-covariance matrix $\Omega = E(\eta_{i,t}, \eta'_{i,t})$. Specifically, the variances and covariances of expected-return news, domestic earnings news, and foreign earnings news are computed as:

$$\begin{aligned}
\text{var}(nr_t) &= \lambda_1'\Omega\lambda_1 \\
\text{var}(nD_t) &= \lambda_2'\Omega\lambda_2 \\
\text{var}(nF_t) &= \lambda_3'\Omega\lambda_3 \\
\text{cov}(nr_t, nD_t) &= \lambda_1'\Omega\lambda_2 \\
\text{cov}(nr_t, nF_t) &= \lambda_1'\Omega\lambda_3 \\
\text{cov}(nD_t, nF_t) &= \lambda_2'\Omega\lambda_3.
\end{aligned}$$

We compute robust standard errors of the variance components using the Shao-Rao [1993] jackknife method.

4. Sample and Data

Accounting and stock return data are taken from annual Compustat and Center for Research in Security Prices (CRSP) files for 1984 through 2001.[20] Institutional ownership data are obtained from the CDA/Spectrum database.

4.1 COMPUSTAT RESTRICTIONS AND VARIABLES DEFINITIONS

We initially include companies in the sample if they are domiciled in the United States with nonmissing values of pretax domestic income (DATA 272), pretax foreign income (DATA 273), and net income (DATA 172). We restrict the sample firms to observations with nonmissing and positive book values of equity (DATA 60) and domestic and foreign sales revenues (from the Compustat Segment File). To compute net income from domestic and foreign operations we require nonmissing foreign taxes payable (DATA 64), foreign deferred taxes (DATA 270), and total income taxes (DATA 16).[21] These restrictions result in a Compustat sample of 14,153 (2,231) firm-years (firms). Net income from foreign operations is computed as pretax foreign income (DATA 273) minus foreign income taxes. Foreign income taxes are computed as foreign taxes payable (DATA 64) plus foreign deferred taxes (DATA 270). Domestic net income is computed as pretax domestic income (DATA 272) minus domestic income taxes. Domestic income taxes are computed as total income taxes (DATA 16) minus foreign income taxes.

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[20] The source of segment data to compute domestic and foreign earnings is Securities and Exchange (SEC) Regulation §210.4-08(h), General Notes to Financial Statements—Income Tax Expense. These data were first included in Compustat in 1984.

[21] As a sensitivity analysis we repeat the analysis assuming that missing values for DATA 64 and DATA 270 take the value of 0. With these assumptions our final sample consists of 7,553 observations (1,510 firms). No inferences are changed with this specification.

We further restrict the sample to companies with at least two lags of book value of equity, one lag of net income, one lag of net income from domestic operations, and one lag of net income from foreign operations. These restrictions reduce the sample to 13,457 (2,285) firm-years (firms).

4.2 CRSP RESTRICTIONS AND VARIABLE DEFINITION

We compute annual stock returns from monthly CRSP data adjusted for dividends. Returns are computed over a period starting nine months before and ending three months after the fiscal year-end. If the firm was delisted we use the delisted return. We require a valid stock return during the last month of the fiscal year to ensure that the return predictability is not spuriously induced by stale prices. We restrict the sample to companies with at least two lags of returns and market value of equity.[22]

4.3 THE MERGED SAMPLE

Matching the CRSP sample with the Compustat sample reduces the sample size to 9,283 (1,642) firm-years (firms). Merging the sample with the CDA/Spectrum database and requiring nonmissing values of institutional holdings reduce the sample to 7,932 (1,511) firm-years (firms).

To ensure that there is no significant discrepancy between the sum of domestic and foreign earnings and total net income, we compute the difference between the sum of domestic and foreign income and net income, scaled by book value of equity. We remove the top and bottom 5% of the ratio for the current and lagged year.[23] This restriction reduces the sample to 6,599 (1,408) firm-years (firms). In addition, we eliminate observations with return on equity, computed as net income scaled by lagged book value of equity, that is less than -1.

Last, to ensure that our results are not driven by extreme observations, we eliminate the top and bottom half percentile of the independent variables in the short VAR specification, that is, lagged excess return, lagged domestic return on equity, lagged foreign return on equity, and lagged book-to-market ratio.[24] After imposing these data constraints, the final sample consists of 6,342 (1,351) firm-years (firms). Table 1 summarizes our sample-selection procedures.

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[22] Consistent with prior research (e.g., Christophe and Pfeiffer [2002]), we exclude very small firms from our sample. In particular, we eliminate observations with lagged market value less than $10 million. We are careful not to impose additional restrictions on year t variables because these are the dependent variables in the regression.

[23] After these removals, the difference between total reported earnings and the sum of domestic and foreign earnings is negligible (when scaled by beginning book value). The mean difference is 0.001, and the first and third quartiles are for all practical purposes equal to 0.

[24] We repeated all tests with different treatments of outliers as well as different screens to ensure that domestic and foreign earnings equal total reported earnings. The reported results are robust to such alternatives.

TABLE 1
Sample Selection

Compustat observations with required accounting data for 1984–2001	10,289
Less: Missing stock return data from CRSP	(1,006)
	9,283
Less: Missing data on institutional holdings in CDA/Spectrum	(1,351)
	7,932
Requirement that sum of domestic and foreign income is close to net income:	
We eliminate the top and bottom 5% of the difference between the sum of domestic and foreign income and net income for the current and lagged year	(1,333)
	6,599
Treatment of extreme observations:	
We eliminate outliers, defined as the top and bottom half percentile of lagged values of excess return, domestic and income (scaled by book value of equity), and book to market	(257)
	6,342
Final sample (1,351 distinct firms)	

5. *Empirical Results*

5.1 DESCRIPTIVE STATISTICS

Descriptive statistics are presented in table 2. Given our requirement that firms have international operations, the sample firms are large, with a mean (median) market value of equity of $3.7 billion ($506 million). The table also reveals considerable variation and skewness in firm size. The sample firms have mean (median) return on equity of 0.12 (0.13) and book-to-market ratio of 0.61 (0.52). The mean (median) domestic and foreign earnings (scaled by book value) are 0.07 (0.08) and 0.05 (0.03), respectively.[25] The standard deviation for domestic earnings is 0.18 and the standard deviation for foreign earnings is 0.09, suggesting that domestic earnings are more variable than foreign earnings. Foreign earnings account for 50% of total earnings on average (whereas the median is 23%).[26] The year-to-year growth rate in sales revenues is higher for foreign sales than for domestic sales, with means (medians) of 0.43 (0.11) and 0.28 (0.07), respectively. Given the considerable difference in growth rates, we consider the effect of differential growth in our tests. Finally, there is large variation in the number of institutions holding shares in the sample firms, the percentage of shares held by institutions, and the percentage of shares held by short- and long-term institutional investors.

[25] Note that the earnings components are not left-skewed, as is usually observed in large samples. The reason is that our sample consists of only multinational companies, which tend to be large and profitable.

[26] The high value for the mean ratio of foreign earnings to total earnings is strongly affected by a few observations. Deleting the top and bottom half percentile of the foreign to total earnings ratio reduces the mean to 35%. However, as the results are not affected by the inclusion or exclusion of such extreme observations, we have chosen not to delete them.

TABLE 2
Descriptive Statistics

	Mean	Q1	Median	Q3	Std. Dev.
MV	3,697	136	506	2,023	14,511
Return	0.17	−0.17	0.08	0.35	0.64
ROE	0.12	0.04	0.13	0.20	0.20
BM	0.61	0.33	0.52	0.78	0.42
DEARN	0.07	0.01	0.08	0.15	0.18
FEARN	0.05	0.00	0.03	0.08	0.09
Foreign %	0.50	0.03	0.23	0.54	5.13
Growth_dom	0.28	−0.01	0.07	0.18	12.8
Growth_for	0.43	−0.04	0.11	0.32	4.18
Inst_Percent	0.49	0.34	0.52	0.66	0.22
Inst_Number	131	30	78	169	156
Short-term investors	0.09	0.04	0.08	0.13	0.08
Long-term investors	0.39	0.28	0.40	0.50	0.16

The variables are defined as follows:

MV = market value of common equity in millions
Return = the cum dividend annual stock return
ROE = return on equity, defined as net income divided by beginning book value of equity
BM = book value of equity divided by market value of equity
DEARN = domestic earnings divided by beginning (total) book value of equity
FEARN = foreign earnings divided by beginning (total) book value of equity
Foreign % = foreign earnings divided by the absolute value of total net income
Growth_dom = year-to-year percentage change in domestic sales revenues
Growth_for = year-to-year percentage change in foreign sales revenues
Inst_Percent = number of shares in a firm held by institutions divided by the total number of shares outstanding
Inst_Number = number of institutions owning shares of the firm
Short-term investors = number of shares in a firm held by short-term (or transient) institutional investors divided by the total number of shares outstanding (based on Bushee [1998])
Long-term investors = number of shares in a firm held by long-term (or dedicated plus quasi-indexers) institutional investors divided by the total number of shares outstanding (based on Bushee [1998])

5.2 TESTS OF H1: VARIANCE CONTRIBUTION OF DOMESTIC EARNINGS VERSUS FOREIGN EARNINGS

The parameter estimates for the short VAR model and their standard errors are shown in panel A of table 3. The return equation shows that returns are negatively associated with past returns and positively associated with lagged domestic and foreign earnings (at the 1% and 10% levels, respectively) as well as with lagged book-to-market. Both domestic and foreign earnings are significantly and positively associated with past returns, but the parameter estimate for domestic earnings (0.106) is approximately three times that of foreign earnings (0.035). Consistent with the finding of Thomas [1999], foreign earnings are more persistent (0.42) than domestic earnings (0.33). Finally, the book-to-market ratio is high when past book-to-market, domestic earnings, and foreign earnings are high, and low when past returns are high.

Panel B of table 3 shows the results of the variance decomposition for the short and long VAR. For both specifications, domestic earnings news and foreign earnings news are each significant at the 1% level (two-tailed). In

TABLE 3

Estimated Parameters of the Vector Autoregressive (VAR) Model and Tests of Hypothesis 1

Panel A: Estimated parameters from the short VAR

	R_{t-1}	$DEARN_{t-1}$	$FEARN_{t-1}$	BM_{t-1}
R_t	−0.103***	0.126***	0.128*	0.049***
	(0.014)	(0.042)	(0.075)	(0.010)
$DEARN_t$	0.106***	0.330***	−0.095***	−0.064***
	(0.005)	(0.014)	(0.027)	(0.004)
$FEARN_t$	0.035***	−0.031***	0.420***	−0.024***
	(0.002)	(0.007)	(0.013)	(0.002)
BM_t	−0.795***	0.215***	0.102***	0.915***
	(0.008)	(0.022)	(0.039)	(0.005)

Panel B: Test of hypothesis 1 (variance decomposition of mean-adjusted returns)

	var(*nr*)	var(*nD*)	var(*nF*)	*DIFF*	cov(*nr*,*nD*)	cov(*nr*,*nF*)	cov(*nD*,*nF*)	*VR*
Short	0.009***	0.081***	0.051***	−0.029***	−0.017***	−0.007***	0.007*	0.202
VAR	(0.001)	(0.011)	(0.005)	(0.007)	(0.003)	(0.002)	(0.004)	
Long	0.005***	0.079***	0.040***	−0.038***	−0.010***	−0.007***	0.015***	0.188
VAR	(0.001)	(0.010)	(0.005)	(0.006)	(0.002)	(0.002)	(0.004)	

Panel C: Relative variance decomposition

	VR	*V*(*nr*)/*VR*	*V*(*nD*)/*VR*	*V*(*nF*)/*VR*	*Vnr*/*VnD*	*VnD*/*VnF*
Short VAR	0.202	0.044	0.399	0.254	0.173	1.574
Long VAR	0.188	0.026	0.419	0.216	0.122	1.943

Panel A lists the parameter estimates for the short VAR. The model variables include the mean-adjusted cum dividend annual excess return r_t (the first element of the state vector z); the mean-adjusted domestic earnings scaled by book value of equity (the second element); the mean-adjusted foreign earnings scaled by book value of equity (the third element), and the mean-adjusted book to market ratio (the fourth element). The parameters in the table correspond to the following system:

$$z_{i,t} = \mathbf{A}z_{i,t-1} + \eta_{i,t}, \qquad \Omega = E(\eta_{i,t}, \eta_{i,t})$$

Two numbers are reported for each parameter. The first number is the fixed-effects panel data estimate and the second is its standard error. The short VAR is based on one lag each of the mean-adjusted cum dividend annual return r_t, the mean-adjusted domestic earnings scaled by book value, the mean-adjusted foreign earnings scaled by book value, and the mean-adjusted book-to-market ratio. The long VAR is based on two lags each of these variables. The sample for the short (long) VAR is composed of 6,342 (4,849) firm-years.

Panel B lists the variance decomposition for the short VAR and long VAR where the variances are defined as follows:

VR = total variance of mean-adjusted excess returns = var(*nr*) + var(*nD*) + var(*nF*) − 2cov(*nr*,*nD*) − 2cov(*nr*,*nF*) + 2cov(*nD*,*nF*)
var(*nr*) = variance of expected-return news
var(*nD*) = variance of domestic earnings news
var(*nF*) = variance of foreign earnings news
cov(*nr*,*nD*) and cov(*nr*,*nF*) = covariance of expected-return news with domestic earnings news and foreign earnings news, respectively
cov(*nD*,*nF*) = covariance between domestic earnings news and foreign earnings news
DIFF = difference between the variance of foreign earnings news and the variance of domestic earnings news = var(*nF*) − var(*nD*)

The standard errors (in parentheses) of the variances are computed using the Shao-Rao [1993] jackknife method.

Panel C lists the relative size of each variance component to the total variance and the relative size of each variance component to other variance components.

* and *** indicate significance at the 10% and 1% levels, respectively (two-tailed).

the short VAR specification, the variance of domestic and foreign earnings news is 8.1% and 5.1%, respectively, and the difference between the two is significant at less than the 1% level. Both earnings variances are significantly larger than the variance of expected-return news (0.9%). However,

expected-return news is significant at the 1% level (consistent with Callen and Segal [2004]), suggesting that it is important to control for changes in expected discount rates. The three covariance terms are relatively small in magnitude for both specifications. The results for the long VAR are similar to those of the short VAR.

Panel C provides an intuitive representation of these results. The table shows that for the short (long) VAR, domestic earnings explain about 40% (42%) of the total variance of the unexpected returns whereas foreign earnings explain about 25% (22%).[27] By comparison, expected-return news explains less than 5% of the total variance.

As discussed earlier, variance contribution is a function of both persistence and variability. Overall, our results indicate that, on average, although foreign earnings are more persistent than domestic earnings, the greater variance of domestic earnings results in domestic earnings contributing more to the variability of unexpected stock returns. Our results are consistent with Thomas [1999], who finds that investors underestimate the persistence of foreign earnings. Thomas emphasizes the difficulty investors face when trying to understand the origin of firms' foreign earnings, in part caused by low-quality disclosures related to foreign operations. Given this uncertainty, investors cautiously underestimate the persistence of foreign earnings.

5.3 SENSITIVITY ANALYSES FOR H1

To minimize the possibility that alternative explanations drive the reported results in table 3 and the testing of H1, we undertake several robustness checks. We consider the impact of firm size, differential growth, sign of earnings and sign of earnings changes, the ratio of foreign earnings to total earnings, income tax issues, and foreign exchange rate effects. Consistent with Vuolteenaho [2002] and Callen and Segal [2004], we implement these robustness checks by forming quintiles based on the magnitude of the control variable of interest.

5.3.1. Size. Firm size could proxy for a host of factors, including information availability and stability of operations. In panel A of table 4 we present results by size quintiles, where size is measured as the market value of equity. For all size groups, domestic earnings have higher variance contribution than foreign earnings, and the difference between the two variances is significant. Hence, the results reported in table 3 are not explained by size. The panel also shows that the estimated variability of domestic and foreign earnings generally decreases with firm size. For example, the variance of domestic (foreign) earnings news decreases from approximately 10% (6%) in quintile 1 to approximately 7% (4%) in quintile 5. Untabulated results show that, consistent with Vuolteenaho [2002] and Callen and Segal [2004], the total variability of unexpected stock returns is also decreasing with firm

[27] In the remainder of the article, for brevity we report only results using the short VAR specification. No inferences are affected when the long VAR specification is used.

TABLE 4
Robustness Tests for Hypothesis 1

Quintile	var(*nr*)	var(*nD*)	var(*nF*)	*DIFF*
Panel A: Effect of firm size (variance decomposition for size quintiles)				
1	0.012***	0.099***	0.059***	−0.040***
	(0.001)	(0.013)	(0.006)	(0.011)
2	0.009***	0.086***	0.053***	−0.033***
	(0.002)	(0.015)	(0.006)	(0.011)
3	0.008***	0.074***	0.054***	−0.020***
	(0.001)	(0.012)	(0.008)	(0.008)
4	0.008***	0.076***	0.051***	−0.025***
	(0.001)	(0.010)	(0.007)	(0.005)
5	0.007***	0.068***	0.039***	−0.029***
	(0.001)	(0.018)	(0.008)	(0.011)
Panel B: Effect of differential growth rates between domestic and foreign operations (variance decomposition for growth-difference quintiles)				
1	0.010***	0.102***	0.068***	−0.034**
	(0.001)	(0.019)	(0.010)	(0.018)
2	0.008***	0.069***	0.044***	−0.025***
	(0.001)	(0.012)	(0.008)	(0.008)
3	0.007***	0.061***	0.036***	−0.025***
	(0.001)	(0.009)	(0.005)	(0.005)
4	0.008***	0.064***	0.036***	−0.028***
	(0.001)	(0.007)	(0.004)	(0.004)
5	0.011***	0.090***	0.062***	−0.028***
	(0.002)	(0.012)	(0.005)	(0.009)
Panel C: Effect of sign of earnings changes (variance decomposition for different combinations of sign of earnings changes)				
D_P, F_P	0.009***	0.079***	0.047***	−0.033***
	(0.001)	(0.014)	(0.006)	(0.009)
D_P, F_N	0.008***	0.066***	0.049***	−0.017***
	(0.001)	(0.009)	(0.006)	(0.006)
D_N, F_P	0.007***	0.079***	0.051***	−0.027**
	(0.001)	(0.016)	(0.005)	(0.012)
D_N, F_N	0.012***	0.102***	0.061***	−0.041***
	(0.002)	(0.020)	(0.008)	(0.016)

size quintile. These findings could reflect in part the greater stability of operations for larger firms. Although the variance contributions of the two earnings components decrease across quintiles, the differences in variance contribution do not exhibit a similar pattern. One potential explanation for this finding is that we are using raw differences in variance contribution and do not scale by total variability. As a robustness test, we scale differences by the total variance of unexpected stock returns of the quintile. Unreported results show that scaled differences do not vary systematically with firm size quintiles.[28]

[28] We conduct similar (untabulated) tests using scaled differences for the tables that follow. No inferences are affected when using scaled differences instead of raw differences.

TABLE 4 — *Continued*

Quintile	var(*nr*)	var(*nD*)	var(*nF*)	*DIFF*
Panel D: Effect of variations in the ratio of foreign to total income (variance decomposition for quintiles of foreign income as percentage of total income)				
1	0.011***	0.101***	0.072***	−0.029**
	(0.001)	(0.018)	(0.008)	(0.014)
2	0.011***	0.113***	0.062***	−0.051***
	(0.001)	(0.018)	(0.009)	(0.013)
3	0.007***	0.060***	0.034***	−0.026***
	(0.001)	(0.008)	(0.005)	(0.005)
4	0.007***	0.055***	0.035***	−0.020***
	(0.001)	(0.008)	(0.003)	(0.006)
5	0.008***	0.074***	0.053***	−0.020***
	(0.001)	(0.010)	(0.007)	(0.006)

See the notes for table 3, panel B. Panel A of this table shows separate (short VAR) results for quintiles of market value of equity to test whether variations in firm size explain the results documented in table 3, panel B. Quintiles 1 to 5 are in increasing order of firm size, measured as market value of equity.

Panel B shows separate (short VAR) results for quintiles of differential growth to test whether variations in growth explain the results documented in table 3, panel B. Quintiles 1 to 5 are in increasing order of the differences in percentage growth in sales revenues between domestic and foreign operations (i.e., domestic − foreign growth).

Panel C shows separate (short VAR) results for different combinations of the sign of earnings changes for domestic and foreign earnings to test whether the sign of earnings changes explains the results documented in Table 3, Panel B (cf. Christophe [2002]).

D_P, *F_P*: Positive domestic earnings change, positive foreign earnings change
D_P, *F_N*: Positive domestic earnings change, negative foreign earnings change
D_N, *F_P*: Negative domestic earnings change, positive foreign earnings change
D_N, *F_N*: Negative domestic earnings change, negative foreign earnings change

Panel D shows separate (short VAR) results for quintiles of the ratio of foreign income to the absolute value of total income to test whether variations in the magnitude of foreign earnings explain the results documented in Table 3, Panel B. Quintiles 1 to 5 are in increasing order of the ratio of foreign earnings to (the absolute value of) total income.

** and *** indicate significance at the 5% and 1% levels, respectively (two-tailed).

5.3.2. Growth. Although the VAR estimation controls for overall firm growth opportunities by explicitly incorporating the book-to-market ratio, we examine further whether the results can be attributed to differential growth between domestic and foreign operations. In panel B of table 4 we split the sample into five groups based on the magnitude of the difference in growth between domestic and foreign sales. We measure growth as the year-by-year percentage change in sales. The results show that the variation of domestic earnings exceeds that of foreign earnings for all quintiles. Moreover, there is no discernible pattern in the difference between domestic and foreign earnings across quintiles. We conclude that differential growth does not explain the results in table 3.

5.3.3. Sign of Earnings Changes and Levels. Christophe [2002] documents that the sign of earnings changes has a major impact on estimated valuation coefficients in an ERC model. However, panel C of table 4 demonstrates that our results are robust to the sign of earnings changes. Specifically, we divide the sample into four groups: positive earnings changes for both domestic and foreign earnings, positive domestic and negative foreign earnings

changes, negative domestic and positive foreign earnings changes, and negative earnings changes for both domestic and foreign earnings. The variance contribution of domestic earnings exceeds that of foreign earnings for all groups and the difference is statistically significant. Unreported results show that similar results obtain when we split the sample based on the sign of earnings levels rather than earnings changes. Consequently, in contrast to the findings of Christophe [2002], our results are not sensitive to the sign of earnings changes or levels.

5.3.4. Ratio of Foreign Earnings to Total Earnings. As a corollary to examining the sign of earnings, we consider the ratio of foreign earnings to total earnings. If foreign earnings constitute a larger portion of total income, one might expect foreign earnings to have greater impact on the variability of unexpected stock returns. We partition our sample into five groups based on the ratio of foreign income to the absolute value of total income. Panel D of table 4 shows the results. For all five groups, domestic earnings contribute more to stock return variability than do foreign earnings. Although there is no monotonic relation, the difference between domestic and foreign earnings is lower for high percentages of foreign earnings. Hence, there appears to be a modest positive relation between the variance contribution of each earnings component and its contribution to total income.[29]

To alleviate potential concerns that our results are related to the relative weight of foreign to domestic earnings, we conduct two additional tests (not tabulated for brevity).[30] For the first test, we estimate nF_t (foreign earnings news) and nD_t (domestic earnings news) for each firm (compare equations (7) and (8)). We then rank each of the news items by the ratio of foreign earnings to total earnings. We find no relation between nF_t and the relative size of foreign earnings news to domestic earnings news and no relation between nD_t and the relative size of foreign earnings news to domestic earnings news. The same result holds if we rank by revenues rather than earnings. As an additional test, we classify observations into two groups: foreign earnings scaled by book value of equity greater than domestic earnings scaled by book value of equity, and vice versa.[31] We then rank the observations within each group according to the difference between the two components of earnings (i.e., domestic earnings minus foreign earnings) and compute the mean of

[29] We repeat this sensitivity analysis using foreign sales as a percentage of total sales instead of the ratio of foreign earnings to total earnings. For all quintiles, the variance of domestic earnings is significantly greater than the variance of foreign earnings. Furthermore, there is no discernible pattern across quintiles.

[30] Note, however, that scale effects, such as the relative weights of foreign and domestic earnings, do not affect our model and results. The reasoning is as follows. Equation (5) is proved mathematically from first principles (i.e., not by intuition alone). Because the left-hand side is denominated in changes in returns, necessarily (i.e., mathematically) each of the news components on the right-hand side is denominated in changes in returns. There is no scale effect in changes in returns space.

[31] For 38% of the observations, foreign earnings exceed domestic earnings.

the absolute value of nD_t and nF_t.[32] Unreported results show that the absolute value of nD_t exceeds the absolute value of nF_t for all groups regardless of whether the foreign earnings component is larger or smaller than the domestic earnings component. In conclusion, there is no scale effect in our reported results.

5.3.5. Income Taxes. Another factor that could affect the relative variance contribution is income taxes. Prior research documents some evidence consistent with firms shifting income to countries with low tax rates (e.g., Collins, Kemsley, and Lang [1998], Klassen, Lang, and Wolfson [1993]). These studies acknowledge that it is difficult to estimate tax effects because researchers have access only to external financial statements and not to income tax records. We repeat the analysis using domestic and foreign earnings before taxes and find results similar to those reported (not tabulated). Although this sensitivity analysis does not exclude the possibility that firms manage their pretax earnings to minimize taxes, our robustness test alleviates the concern that our results are driven by differential tax expense for domestic and foreign operations.

5.3.6. Foreign Exchange Rate Effects. Bodnar and Weintrop [1997] note that foreign income changes incorporate an exchange rate effect. However, they demonstrate that their results are not affected by changes in exchange rates. Similarly, Denis, Denis, and Yost [2002, fn. 16] state that their results and the results in the prior literature suggest that "exchange rate volatility has little impact on the valuation effect of global diversification." Nevertheless, given the potential importance of foreign exchange rate effects, we examine whether incorporating the unrecognized foreign exchange gains or losses, recorded in other comprehensive income, affects reported results. Specifically, we add the change in the accumulated foreign exchange translation adjustment (Compustat item 230) to foreign earnings. No inferences are changed when using this adjusted foreign income number (not tabulated for brevity).

Collectively, the evidence presented in tables 3 and 4 and the additional sensitivity analyses described earlier suggest that domestic earnings are more important in explaining stock returns than foreign earnings.

5.4 TESTS OF H2: THE IMPACT OF INVESTOR SOPHISTICATION

We follow the extant accounting literature and use institutional ownership (both the percentage of shares held by institutions and the number of institutions holding shares) as a proxy for investor sophistication (e.g., Hand [1990], Walther [1997], Bartov, Radakrishnan, and Krinsky [2000], Bradshaw, Bushee, and Miller [2004]). Consistent with the prior literature,

[32] Note that we have to look at the absolute values because in the variance decomposition computation we essentially square the related news items.

TABLE 5

Tests of Hypothesis 2

Panel A: Test of hypothesis 2 using the percentage shares owned by institutions (variance decomposition for quintiles of number of shares held by institutions divided by the total number of shares outstanding)

Quintile	var(nr)	var(nD)	var(nF)	*DIFF*
1	0.013***	0.121***	0.070***	−0.051***
	(0.002)	(0.021)	(0.009)	(0.017)
2	0.008***	0.076***	0.045***	−0.031***
	(0.001)	(0.013)	(0.005)	(0.010)
3	0.008***	0.066***	0.043***	−0.024***
	(0.001)	(0.01)	(0.005)	(0.006)
4	0.008***	0.063***	0.039***	−0.024***
	(0.001)	(0.008)	(0.007)	(0.005)
5	0.008***	0.077***	0.058***	−0.019***
	(0.001)	(0.013)	(0.008)	(0.007)

Panel B: Test of hypothesis 2 using the number of institutions owning shares in a firm (variance decomposition for quintiles of number of institutions)

Quintile	var(nr)	var(nD)	var(nF)	*DIFF*
1	0.011***	0.104***	0.061***	−0.042***
	(0.001)	(0.014)	(0.006)	(0.012)
2	0.010***	0.087***	0.053***	−0.034***
	(0.002)	(0.014)	(0.007)	(0.009)
3	0.008***	0.080***	0.053***	−0.027***
	(0.001)	(0.014)	(0.006)	(0.011)
4	0.008***	0.074***	0.050***	−0.024***
	(0.001)	(0.010)	(0.006)	(0.007)
5	0.007***	0.059***	0.039***	−0.020***
	(0.001)	(0.013)	(0.009)	(0.005)

Panel C: Two-stage least squares (2SLS) tests of investor sophistication and the relative variance contribution of domestic and foreign earnings

	Model 1	Model 2
Dependent Variable	*DIFF*	*DIFF*
Intercept	0.053***	0.058***
	(0.006)	(0.005)
Inst_Percent	−0.054***	
	(0.012)	
Inst_Number		−0.007***
		(0.001)

institutions consist of banks, insurance companies, investment companies and their managers, independent advisors, and others.[33]

Panel A of table 5 reports the variances of domestic and foreign earnings and the difference between them by quintiles formed on the basis of the percentage of total shares owned by institutions. Although the variance contribution of domestic earnings is higher regardless of institutional ownership, the difference between domestic and foreign decreases monotonically with the percentage ownership by institutions. The difference for quintile 5 (i.e.,

[33] Source: CDA/Spectrum.

TABLE 5 — *Continued*

Panel C: Two-stage least squares (2SLS) tests of investor sophistication and the relative variance contribution of domestic and foreign earnings

Dependent Variable	*Inst_Percent*	*Inst_Number*
Intercept	0.141***	0.654***
	(0.013)	(0.031)
SIZE	0.059***	0.561***
	(0.002)	(0.004)
RATE	−0.007***	0.009***
	(0.001)	(0.003)
SP500	−0.030***	0.008
	(0.007)	(0.017)
LIQ	0.323***	0.296***
	(0.028)	(0.067)
DYLD	−0.402***	0.752**
	(0.132)	(0.308)
BETA	−0.009**	0.034***
	(0.004)	(0.010)
LEV	0.044***	−0.027
	(0.017)	(0.039)
MAR	0.968***	4.878***
	(0.07)	(0.165)
DPOS	0.026***	−0.003
	(0.008)	(0.018)
SGR	−0.049***	−0.098***
	(0.016)	(0.037)
R&D	−0.065*	−0.083
	(0.037)	(0.086)

See the notes for table 3, panel B. This table tests whether the variance contribution of domestic versus foreign earnings varies with the degree of investor sophistication measured as the percentage of shares owned by institutions (H2). Quintiles 1 to 5 in panel A are in increasing order of the percentage shares held by institutions, and quintiles 1 to 5 in panel B are in increasing order of the number of institutions owning shares in a firm.

Variables in panel C are defined as follows:

Size = log of market value of equity at the end of the fiscal year
ROE = return on equity (net income divided by ending book value of equity)
BM = book value of equity divided by market value of equity
RATE = Standard & Poor's stock rating
SP500 = 1 if the firm is included in the S&P 500, and 0 otherwise
LIQ = liquidity (log of average monthly volume divided by shares outstanding over prior year)
DYLD = dividend yield (Compustat 21/24)
BETA = market model beta estimated from up to 36 prior monthly returns
LEV = leverage, measured as debt to assets (Compustat (9 + 34)/6)
MAR = market-adjusted returns over the fiscal year
DPOS = 1 if earnings are positive, and 0 otherwise
SGR = average sales growth over prior three years (Compustat 12)
R&D = R&D expense divided by sales (Compustat 46/12)

We first regress the proxy for investor sophistication (percentage held by institutions and number of institutions, respectively) on instruments based on Bushee [2001]. We then use the fitted value from this regression as the measure of investor sophistication in a regression where *DIFF*, the difference between domestic and foreign earnings news for each firm-year observation (compare notes for table 3, panel B), is the dependent variable and test whether the estimated coefficient on investor sophistication is negative. We estimate the variance decomposition separately for each firm-year observation by computing the covariance matrix for each observation and assuming that all observations have the same VAR coefficient matrix. Starting with the sample described in table 1, we require *LIQ*, *DYLD*, *BETA*, *LEV*, and *R&D* to be positive. We further require *MAR* and *SGR* to be nonmissing. In addition, we remove the top and bottom percentile of *DIFF*, *SGR*, and *BETA*. These requirements result in a sample of 5,447 firm-year observations.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively (two-tailed).

the group with the highest percentage of institutional ownership) is only 37% of the difference for quintile 1. Panel B reports results using the number of institutions holding the stock. These results are similar and suggest that the relative variance contribution of earnings components depends on the degree of investor sophistication.

One of the limitations of the quintile ranking approach is that it does not allow for testing whether the difference in variance contribution is statistically related to the degree of investor sophistication. We alleviate this problem by estimating the difference in the variance contribution of the two components of earnings *at the firm-year level*. Specifically, we estimate the variance decomposition separately for each firm-year observation by estimating the firm-year's covariance matrix and assuming that all observations have the same VAR coefficient matrix. We then compute the difference between the two components of earnings for each firm-year observation. Finally, we regress the difference between the variance contribution of domestic and foreign earnings on the investor sophistication measures and test whether the estimated coefficient is negative.[34]

Bushee [1998] documents that institutional investors affect firms' investments in R&D, suggesting that it may be important to consider the endogenous nature of ownership when examining firms' investment decisions in domestic and foreign operations.[35] The Hausman [1978] test rejects exogeneity of institutional ownership with respect to our list of instruments (described next) at the 5% level.[36] Consequently, we report results of tests using 2SLS.[37]

We base our instruments for institutional ownership on Bushee [2001]. Firm size (*SIZE*), measured as the log of market value of equity, controls for the fact that institutions generally prefer large firms. Standard & Poor's stock rating (*RATE*) is included to proxy for the prudence of the investment. The

[34] As a sensitivity analysis, we repeat the analysis at the portfolio level. Specifically, we form 100 portfolios based on the level of institutional ownership such that each portfolio has the same number of observations. We estimate the variance decomposition separately for each portfolio by assuming that the observations in each portfolio share the same covariance matrix and all observations (across portfolios) share the same VAR coefficient matrix. We compute the difference between the two components of earnings for each portfolio and regress the difference on the mean institutional ownership of each portfolio. As an additional test, we estimate the variance decomposition for each portfolio assuming portfolio-specific VAR coefficient matrices. The results obtained using these alternative methodologies are consistent with those reported here.

[35] However, note that the emphasis in our study is not the *level* of domestic earnings compared with foreign earnings but the *variance contribution* of each.

[36] This test involves first regressing institutional ownership on the instruments. In the second stage, the difference between the variability of domestic and foreign earnings is regressed on the proxy for investor sophistication as well as on the residuals from the first stage. If the residuals have significant explanatory power, institutional ownership is presumed to be endogenous to the set of instruments.

[37] We also estimated the regression using ordinary least squares (OLS) as well as panel data firm fixed effects and find results consistent with those reported.

average trading volume divided by the average number of shares outstanding (*LIQ*) controls for liquidity preferences. We add an indicator variable for whether a firm is included in the S&P 500 index (*SP500*), as some institutions index a portion of their investments. Dividend yield (*DYLD*) controls for institutions' preference for firms that issue dividends. We include two measures of risk: market model beta (*BETA*) and leverage measured as the debt-to-assets ratio (*LEV*). To capture firm performance, we incorporate market-adjusted returns for the year (*MAR*); an indicator variable (*DPOS*) equal to 1 if earnings are greater than zero, and 0 otherwise; and the average sales growth over the last three years (*SGR*). Finally, we include the firm's R&D intensity (*R&D*), measured as R&D expense divided by sales revenue.

Panel C of table 5 shows the results of the 2SLS tests. Models 1 and 2 use the percentage of total shares held by institutions and the number of institutions holding the stock as proxies for investor sophistication, respectively. Most of the estimated coefficients for the first-stage equation are highly significant and consistent with those reported by Bushee [2001]. More important, the estimated coefficient on investor sophistication is negative as predicted (−0.054) and significant at less than the 1% level (two-tailed test). This result also holds for the other proxy for investor sophistication, the number of institutions holding shares in the company (−0.007). The evidence provided in panel C supports the findings in panels A and B of table 5 and suggests that variance contributions of foreign versus domestic earnings are a function of the degree of investor sophistication. In particular, we find that the relative variance contribution of foreign earnings increases with investor sophistication.

It is conceivable that some of the instruments used in the first stage of the estimation are endogenous to the difference in variance contribution. As an alternative to the 2SLS estimation, we conduct a single-stage estimation in which we regress the difference in variance contribution on our proxy for investor sophistication as well as on all the instruments used previously. The results of these tests (untabulated) are consistent with those reported earlier.

Another issue is that our approach for testing the association between investor sophistication and the relative variance contributions of foreign and domestic earnings is indirect because investor sophistication is not accounted for directly in the VAR system. Yet, the VAR coefficient matrix itself may be affected by the degree of investor sophistication. Fortunately, this concern is less acute than it might be because security prices reflect the level of investor sophistication (e.g., Walther [1997], Bartov, Radakrishnan, and Krinsky [2000]) and our VAR system matrix includes prices through the book-to-market and returns variables. Nonetheless, to alleviate this concern, we reestimate the VAR system after including investor sophistication as another state variable in the VAR matrix. The (nontabulated) results obtained are similar to those reported in table 5 (and in table 6).

Our research suggests that not all investors are equal in interpreting information about firms and assessing earnings components. In particular,

TABLE 6

Two-Stage Least Squares (2SLS) Tests of Short- Versus Long-Term Institutional Investors and the Relative Variance Contribution of Domestic and Foreign Earnings

Dependent Variable	Model 1 *DIFF*	Model 2 *DIFF*	Model 3 *DIFF*
Intercept	0.014***	0.026***	0.026***
	(0.003)	(0.006)	(0.006)
Short-term investors	0.0005		0.040
	(0.029)		(0.034)
Long-term investors		−0.031**	−0.041**
		(0.015)	(0.017)
Dependent Variable	*Short-term investors*	*Long-term investors*	
Intercept	0.020***	0.141***	
	(0.006)	(0.013)	
SIZE	0.011***	0.042***	
	(0.001)	(0.002)	
RATE	−0.005***	−0.003***	
	(0.001)	(0.001)	
SP500	0.007**	−0.013*	
	(0.003)	(0.007)	
LIQ	0.179***	0.198***	
	(0.016)	(0.035)	
DYLD	−0.266***	0.026	
	(0.049)	(0.110)	
BETA	0.004*	−0.005	
	(0.002)	(0.005)	
LEV	0.002	−0.012	
	(0.008)	(0.017)	
MAR	0.799***	0.076	
	(0.039)	(0.088)	
DPOS	0.003	0.018**	
	(0.004)	(0.008)	
SGR	0.041***	−0.095***	
	(0.007)	(0.017)	
R&D	0.086***	−0.082**	
	(0.016)	(0.035)	

See the notes explaining the instruments in table 5, panel C. *Short-term investors* are transient investors following Bushee [1998]. *Long-term investors* are dedicated investors and quasi-indexers following Bushee [1998]. In model 1 (2) [3], we first regress the proxy for short-term institutional investors (long-term institutional investors) [short- and long-term investors] on instruments based on Bushee [2001]. We then use the fitted values from this regression as the test variable in a regression where *DIFF*, the difference between domestic and foreign earnings news for each firm-year observation (compare explanations for table 3, panel B), is the dependent variable and test whether the estimated coefficient on investor sophistication is negative. We estimate the variance decomposition separately for each firm-year observation by computing the covariance matrix for each observation and assuming that all observations have the same VAR coefficient matrix. For brevity, we do not report the first-stage results for model 3. Starting with the sample described in table 1, we first intersect this data set with data on classifications of institutional investors through 1999 obtained from Brian Bushee, resulting in a sample of 4,132 firm-year observations. We require *LIQ*, *DYLD*, *BETA*, *LEV*, and *R&D* to be positive. We further require *MAR* and *SGR* to be nonmissing. In addition, we remove the top and bottom percentile of *DIFF*, *SGR*, and *BETA*. These requirements result in a sample of 3,591 firm-year observations.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively (two-tailed).

sophisticated investors presumably are better equipped to analyze publicly available disclosures and to use other nonpublic sources to learn about the underlying operations of firms—be they domestic or international. Building on Thomas [1999] and Grinblatt and Keloharju [2001], our results are

consistent with sophisticated investors being less biased than other investors. Our results are also consistent with Price's [1998] and Ke and Petroni's [2003] conclusions that informed investors make better use of both firm-provided disclosures and privately acquired information about the firms in which they invest. In addition, our findings are consistent with Thomas [2004], who documents that the foreign earnings anomaly (i.e., that investors, on average, underestimate the persistence of foreign earnings) is decreasing in proxies for the level of investor sophistication.

Our results are also consistent with Denis, Denis, and Yost's [2002] argument that global diversification destroys value because of suboptimal investments. They argue that extending a corporation's operations internationally leads to a more complex organization, which in turn leads to higher costs of coordination (i.e., an agency cost argument). Bushee [1998] argues that institutions have strong incentives to incur the costs of explicitly monitoring managers. Consequently, greater institutional ownership mitigates the agency costs associated with increased global operations.

Another possible explanation for our results is related to the home bias phenomenon. For example, sophisticated investors such as pension funds are often constrained in their foreign capital market activities. As a consequence, they may want to achieve greater international portfolio diversification by investing in multinational domestic firms that have greater foreign earnings exposure. To examine whether our results are influenced by the home bias phenomenon, we include foreign sales (or earnings) as a percentage of total sales (earnings) as an additional instrument. These proxies also allow us to control for the relative importance of the scale of foreign operations. Untabulated results show that inferences are unchanged with this specification.

One potential caveat of our results is that we document an association but do not establish causality between investor sophistication and the variance contribution of foreign versus domestic earnings. Although our empirical results suggest causality between investor sophistication and the relative variance contribution, reverse causality is also possible. In particular, if foreign operations introduce more uncertainty and volatility into earnings, sophisticated investors may endogenously choose to invest in companies with greater foreign earnings exposure (e.g., Kyle [1985]). Under this scenario, the direction of causality is reversed.

5.5 TESTS OF H3: SHORT-TERM VERSUS LONG-TERM INSTITUTIONAL INVESTORS

Table 6 reports 2SLS results of tests that examine whether the level of investment by long-term (short-term) institutional investors is related (not related) to the difference between the variance contribution of foreign and domestic earnings. We use the same methodology as earlier but split institutional ownership into short- and long-term orientation based on Bushee's [1998] classifications. Following Bushee [2001], we use the same set of instruments for both short- and long-term investors.

The first-stage results in table 6 are, for the most part, consistent with the results in Bushee [2001]. The table further reveals significant differences between short- and long-term investors. Models 1 and 2 show that whereas the difference between the variance contribution of domestic and foreign earnings is significantly and negatively related to the amount of investment by long-term institutional investors, there is no significant relation between this difference in variance contribution and short-term, or transient, investors. We also report results in which we include both short- and long-term investors in the same regression. Model 3 of table 6 shows that the results continue to hold with this alternative specification. Overall, these results are consistent with our earlier discussion in section 2 regarding sophisticated investors' analysis of financial information, access to private information, and monitoring of managers' investment decisions. These arguments are more descriptive for long-term, stable investors who have strong incentives to invest in scrutinizing their investments and monitoring firm performance. Short-term investors, on the other hand, are typically viewed as momentum traders who primarily focus on short-term gains.

6. Conclusions

In this article we employ a variance decomposition model to assess the relative variance contribution of domestic versus foreign earnings. The variance contribution of each earnings component is jointly determined by the variance of the earnings component and its persistence.

We document that domestic earnings contribute significantly more to unexpected stock return variability than do foreign earnings. This finding is robust to several alternative explanations such as the sign of the earnings components, the sign of the change in foreign and domestic earnings, the difference in growth rates of foreign and domestic sales, firm size, taxes, and exchange rate effects.

One possible explanation for the lower variance contribution of foreign operations is the poor disclosure about these operations. Multinational firms often do not provide sufficient details on their foreign operations for investors to assess the risk and return characteristics of these operations. In addition, given the latitude in segment definition as manifested in SFAS No. 14 (and SFAS No. 131), there is a lack of comparability and consistency in segment definition both across firms and over time for the same firm. Another possible explanation is agency based. Management may find that investment in foreign markets is a desirable outlet for suboptimal investments, as foreign operations are harder to understand and monitor by investors.

Not all investors have the same insight into the firm or the same perception of differential earnings streams, however, and this motivates our second hypothesis. We find that the difference between the variance contribution of domestic and foreign earnings decreases with the level of investor sophistication. Finally, we compare short-term (or transient) and long-term

institutional investors using Bushee's [1998] classifications. We show, consistent with our predictions, that the relative variance contribution of domestic and foreign earnings is only significantly related to the level of ownership by long-term, stable institutional investors.

The negative association between the degree of investor sophistication and the difference in the variance contribution of domestic earnings and foreign earnings provides further evidence that sophisticated investors differ from other investors. In our context, potential explanations include sophisticated investors' greater ability to analyze publicly available information pertaining to the operations of the firm or direct communication with management, or both.

A possible extension to our current work involves examining whether institutions that have more experience with non-U.S. stocks evaluate foreign earnings differently from other investors. One way of testing this would be to separate investors based on the percentage of their portfolios in foreign companies.

APPENDIX A

We extend the parsimonious asset pricing model of Campbell, Lo, and MacKinlay [1997, chap. 7] to provide additional intuition about the variance decomposition methodology. In particular, this model illustrates the relation between ERCs and the variance contribution measures, albeit in a more simplified environment than the VAR environment of our tests. Unlike the VAR, the following time-series model does not account for variables other than earnings and, moreover, does not cover all aspects of the earnings process (e.g., nonlinearities in the earnings-returns relation such as in Basu [1997]).[38]

Following Campbell, Lo, and MacKinlay (1997), we assume that expected return, $E_t(r_{t+1})$, is composed of a constant plus time-varying return (r_t^h):

$$E_t(r_{t+1}) = \alpha^r + r_t^h, \tag{A1}$$

and we assume r_t^h is a zero mean stationary AR(1) variable:

$$r_t^h = \beta^r r_{t-1}^h + \varepsilon_t^r. \tag{A2}$$

Substituting (A2) into (A1) yields

$$E_t(r_{t+1}) = \alpha^r + \beta^r r_{t-1}^h + \varepsilon_t^r. \tag{A3}$$

We further assume that foreign earnings and domestic earnings are stationary AR(1) processes with drift:[39]

$$DEARN_t = \alpha^D + \beta^D DEARN_{t-1} + \varepsilon_t^D, \tag{A4}$$

$$FEARN_t = \alpha^F + \beta^F FEARN_{t-1} + \varepsilon_t^F. \tag{A5}$$

[38] However, the analysis can be generalized to more complex time-series models that can incorporate nonlinearities of the Basu [1997] type. The analysis is available on request.

[39] The arguments go through without the drift terms.

We assume for simplicity that the risk-free rate, i_t, is constant over time and the error terms $(\varepsilon_t^r, \varepsilon_t^D, \varepsilon_t^F)$are zero mean and independent of each other. In addition, the persistence terms $(\beta^r, \beta^D, \beta^F)$ lie between 0 and 1. Defining the unexpected stock return components as expected-return news (nr), domestic earnings news (nD), and foreign earnings news (nF), valuation equation (5) in the text shows that:

$$r_t - E_{t-1}(r_t) = nD_t + nF_t - nr_t. \tag{A6}$$

Substituting the assumed dynamics (A3) to (A5) into (A6) (and assuming for simplicity that $\rho = 1$) yields:[40]

$$r_t - E_{t-1}(r_t) = \frac{\varepsilon_t^D}{(1-\beta^D)} + \frac{\varepsilon_t^F}{(1-\beta^F)} - \frac{\varepsilon_t^r}{(1-\beta^r)}. \tag{A7}$$

Equation (A7) shows that holding all other factors constant (including the variances of the earnings components), a 1% shock to domestic earnings causes unexpected returns to change by $1/(1-\beta^D)$. In other words, $1/(1-\beta^D)$ is the standard ERC for domestic earnings. Similarly, $1/(1-\beta^F)$ is the ERC for foreign earnings. Hence, the ERCs in this simple model are solely a function of the persistence parameter, and the more persistent the specific earnings component, the greater is its ERC and value relevance.

Taking the variance of both sides of equation (A7) yields the variance decomposition:

$$VAR(r_t - E_{t-1}(r_t)) = \frac{(1+\beta^D)}{(1-\beta^D)}\sigma_D^2 + \frac{(1+\beta^F)}{(1-\beta^F)}\sigma_F^2 + \frac{(1+\beta^r)}{(1-\beta^r)}\sigma_r^2, \tag{A8}$$

where σ_D^2 is the variance of domestic income (*DEARN*), σ_F^2 is the variance of foreign income (*FEARN*), and σ_r^2 is the variance of the expected future returns (r_t^h).[41,42]

This simple model shows that the variance of unexpected returns is an increasing function of both the variances *and* persistence of foreign earnings, domestic earnings, and expected future returns. The impact of each type of earnings on the variance of unexpected returns depends on the interaction between the persistence of the earnings component and its variability. Equation (A8) shows that the relative effect of domestic and foreign earnings in

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[40] More generally, unexpected returns are:

$$r_t - E_{t-1}(r_t) = \frac{\varepsilon_t^D}{(1-\rho\beta^D)} + \frac{\varepsilon_T^F}{(1-\rho\beta^F)} - \frac{\varepsilon_t^r}{(1-\rho\beta^r)}.$$

In the empirical work, ρ is assumed to equal 0.967 following Campbell [1991] and Vuolteenaho [2002].

[41] Note that equation (A2) and stationarity imply that $\sigma_{\varepsilon_r}^2 = (1-\beta^{r^2})\sigma_r^2$ and similarly for the variances of ε_D and ε_F, where $\sigma_{\varepsilon_r}^2$ is the variance of the return shock.

[42] If the error terms are not independent of each other, equation (A8) will also have covariance terms, as is the case for the VAR model in the text.

explaining the variance of unexpected returns is determined by comparing the terms:

$$\frac{1+\beta^D}{1-\beta^D}\sigma_D^2 \quad \text{with} \quad \frac{1+\beta^F}{1-\beta^F}\sigma_F^2. \tag{A9}$$

For our sample, the persistence of domestic income (0.57) is less than the persistence of foreign income (0.63), but this is offset by the fact that the variance of domestic income (0.0324) is much greater than the variance of foreign income (0.0081).[43] The interaction of these two factors yields the result that domestic earnings are more important in driving ex post returns than are foreign earnings.

Intuitively, the variance of unexpected returns depends not only on the variability of current unexpected domestic and foreign earnings but also on the variability of future unexpected domestic and foreign earnings (which we call news). In this simple model, the impact of the variability of future unexpected domestic and foreign earnings on the variability of unexpected returns is captured by the *discounted value* of domestic and foreign earnings variances where the discount rates are a function of the persistence levels of domestic and foreign earnings, respectively.

APPENDIX B

This appendix describes the derivation of the Campbell and Shiller [1988a, b] model and the Vuolteenaho [2002] extension.

B1. The Campbell-Shiller Model

Campbell and Shiller [1988a, b] start with the basic definition of stock return:

$$\begin{aligned} r_t &= \log[(P_t + D_t)/(P_{t-1})] = \log(P_t + D_t) - \log(P_{t-1}) \\ &= p_t - p_{t-1} + \log(1 + \exp(d_t - p_t)), \end{aligned} \tag{B1}$$

where:

$r_t =$ log (cum dividend) equity return at time t
$P_t =$ market value at time t
$D_t =$ dividends at time t
$p_t =$ log market value at time t
$d_t =$ log dividends at time t

To generate a (log) linear valuation equation, Campbell and Shiller linearize equation (B1) by a Taylor approximation, yielding

$$r_t \approx h + \rho p_t + (1-\rho)\, d_t - p_{t-1}, \tag{B2}$$

[43] These persistence numbers obtain from OLS regressions of equations (A4) and (A5) using our sample data. The more comprehensive VAR model in our tests yields persistence estimates of 0.33 for domestic earnings and 0.42 for foreign earnings (see panel A of table 3). The variances are from table 2.

where h is a constant and $\rho < 1$ is a constant error approximation term. Replacing the approximation symbol by an equality, solving equation (B2) forward for price, taking expectations, and assuming the transversality condition $\lim_{j\to\infty} \rho^j p_{t+j} = 0$ yields the valuation equation:

$$p_t = \frac{\kappa}{1-\rho} + E_t\left[\sum_{j=0}^{\infty} \rho^j [(1-\rho)\, d_{t+1+j} - r_{t+1+j}]\right], \tag{B3}$$

where κ is a constant. Substituting equation (B3) into equation (B2) and taking expectations yields the unexpected change in current returns:

$$r_t - E_{t-1}(r_t) = \Delta E_t \sum_{j=0}^{\infty} \rho^j \Delta d_{t+j} - \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j}. \tag{B4}$$

B2. The Vuolteenaho Model

Vuolteenaho [2002] starts with basic definition of the log book to market ratio bm_t and the clean surplus identity:

$$bm_t = \log\left(\frac{BV_t}{P_t}\right) = \log\left(\frac{\left(1 + \frac{X_t}{BV_{t-1}} - \frac{D_t}{BV_{t-1}}\right)}{\left(\left(1 + \frac{\Delta P_t + D_t}{P_{t-1}}\right) - D_t/P_{t-1}\right)} * \frac{BV_{t-1}}{P_{t-1}}\right), \tag{B5}$$

where BV_t is the book value of equity at time t, and X_t is net income in period t. Using a Taylor-series approximation (by expanding around a convex combination of the unconditional means of the log dividend-to-book-value and the log dividend-to-price ratios) yields

$$roe_t - i_t - r_t \approx \rho\, bm_t - bm_{t-1}, \tag{B6}$$

where roe_t = log book return on equity in period t = $\log(1 + X_t/BV_{t-1})$ and i_t = log of 1 plus the risk-free rate in period t.

Replacing the approximation symbol by equality, solving equation (B6) forward for the lagged book-to-market ratio, and assuming that $\rho^{N+1} bm_{t+n}$ converges to a finite limit as $N \to \infty$ yields:

$$bm_{t-1} = \sum_{j=0}^{\infty} \rho^j r_{t+j} - \sum_{j=0}^{\infty} \rho^j (roe_{t+j} - i_{t+j}). \tag{B7}$$

Solving (B6) for r_t and taking the difference in expectations between time t and time $t-1$ yields the Vuolteenaho model:

$$r_t - E_{t-1}(r_t) = \Delta E_t \sum_{j=0}^{\infty} \rho^j (roe_{t+j} - i_{t+j}) - \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j}. \tag{B8}$$

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