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journal homepage: www.elsevier.com/locate/jieCorrelated beliefs, returns, and stock market volatility[☆]Joel M. David^a, Ina Simonovska^{b,*}^a University of Southern California, United States^b University of California, Davis, NBER, United States

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ABSTRACT

Firm-level stock returns exhibit comovement above that in fundamentals, and the gap tends to be higher in developing countries. We investigate whether correlated beliefs among sophisticated, but imperfectly informed, traders can account for the patterns of return correlations across countries. We take a unique approach by turning to direct data on market participants' information — namely, real-time firm-level earnings forecasts made by equity market analysts. The correlations of firm-level forecasts exceed those of fundamentals and are strongly related to return correlations across countries. A calibrated information-based model demonstrates that the correlation of beliefs implied by analyst forecasts leads to return correlations broadly in line with the data, both in levels and across countries — the correlation between predicted and actual is 0.63. Our findings have implications for market-wide volatility — the model-implied correlations alone can explain 44% of the cross-section of aggregate volatility. The results are robust to controlling for a number of alternative factors put forth by the existing literature.

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1. Introduction

Stock returns exhibit 'excess comovement' — that is, comovement, or correlation, above and beyond what can be explained by fundamentals. Moreover, the extent of excess comovement differs across countries, and in a systematic way: emerging markets tend to exhibit higher degrees of comovement than do developed ones. Understanding the determinants of these patterns is important because the correlation of returns is a key driver of aggregate stock market volatility, which has implications for investment incentives on the part of firms, portfolio choice decisions on the part of investors, and ultimately, the efficiency of the allocation of capital.

In this paper, we take a new look at the drivers of differences in firm-level stock return correlations across countries. Specifically, we investigate the role of correlated beliefs on the part of sophisticated, but imperfectly informed, investors. Quantifying this channel is challenging, since we as the econometricians do not typically observe agents' information

sets. We take a novel approach to overcoming this hurdle by turning to direct data on market participants' forecasts of firm fundamentals. We obtain these forecasts from the I/B/E/S Database, which tracks firm-level forecasts made by security analysts across a number of developed and emerging markets. We use these data to document a new fact that sheds light on the role of correlated beliefs: the correlations of analyst forecasts are strongly related to firm-level return correlations across countries, and both exceed the level justified by fundamentals.

To reconcile these findings and to investigate their implications for return correlations and market-wide volatility, we develop a highly parsimonious dynamic model of equity markets under imperfect information. Market participants trade based on their priors and a noisy signal of the current innovation in fundamentals. There is correlation across firms both in fundamentals and in the noise in signals, both of which lead to correlated beliefs. The model makes sharp predictions regarding the correlation in returns and conditions for excess correlation above that in fundamentals — in fact, the simplicity of our setting leads to a sharp characterization of the return correlation as a weighted average of the correlation in fundamentals and signal errors.

We perform a straightforward numerical exercise to assess whether the correlation in beliefs that we measure leads to patterns in return correlations in line with those observed in the data. We calibrate the model using the cross-firm correlations of forecasts from I/B/E/S (and their volatilities) along with readily observable properties of fundamentals. We have several key findings: first, the calibrated

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model generates return correlations broadly in line with those in the data – the correlation between predicted and actual across countries is 0.63. Moreover, the levels are on par, averaging 0.47 and 0.46, respectively. In other words, the correlation of information suggested by our data leads to cross-sectional patterns as well as levels of excess correlations similar to those in the data. This is a rather striking finding given the simplicity of our setting and empirical approach.

We perform a series of counterfactual experiments to disentangle the various potential drivers of return correlations in the model and we find that the non-fundamental component of belief correlation is key. In particular, setting the correlation of signal errors to the US level for all countries almost eliminates disparities in return correlations, while setting overall signal noise and fundamental parameters to their US values yields similar return correlations as the baseline calibration. This highlights an important and intuitive result from our model: it is not the overall level of firm-specific information that drives comovement across firms, but rather the correlated component of that information. Our distinction between the commonality of information as opposed to its overall quality helps to reconcile an apparent tension in the recent literature – namely, some studies have found that comovement is higher where stock prices are more informative, some have found the opposite, and others have found the relationship to be non-monotonic.¹ We find a rather weak relationship, in large part because the extent of correlation in information is not strongly related to its overall precision.

We take our analysis one step further and examine the implications of our results for cross-sectional differences in aggregate stock market volatility. Previous work has shown that cross-firm return correlations alone explain a substantial portion of variation in market-wide volatility, and it seems natural to ask if our results have anything to add on this score.² We find that the answer is yes: a simple regression shows that our predicted return correlations alone can explain about 44% of the cross-country variation in aggregate volatility in an R^2 sense; for comparison, in our data, the empirical return correlations explain about 64% of the variation in volatility. Our finding here is not surprising once we notice that there is a strong direct relationship between analyst forecast correlations and market volatility. We interpret this result as suggesting that future work investigating the determinants of stock market volatility should take seriously the role of correlated beliefs across presumably sophisticated traders.

We perform a number of additional exercises geared towards understanding the implications of some important variations on our baseline analysis. First, we demonstrate that excess return correlation is a robust phenomenon across various frequencies – specifically, while our benchmark analysis focuses on annual data, the excess correlation of returns compared to fundamentals features in higher-frequency (quarterly) data as well. Relatedly, we show that excess correlation of forecasts remains present over the forecasting horizon. In particular, while our baseline analysis focuses on forecasts made the month following the release of the prior year's earnings, the cross-firm correlations of forecasts, although generally declining, remain high even up to one month prior to the end of the period for which the forecast is made. We show that this is the case even though informational quality, measured by the precision of investor information, is generally increasing as the forecast horizon shortens. We also present evidence that analyst information is a plausible, albeit imperfect, proxy for the information of informed traders more generally. In particular, we document that many types of investors purchase information from analysts, that investors react to that information, and lastly, that based on the sources on which analysts rely to form expectations, we might expect a significant

degree of overlap between their information sets and those of a broader set of informed investors, whether or not they turn to analysts directly for that information.

Additionally, we address in detail the potential role of aggregate shocks to discount rates in driving excess comovement. First, we show that, in our framework, imperfect information leads to movements in asset prices unrelated to fundamentals – in other words, shocks to beliefs resemble what the literature would typically ascribe to discount rate fluctuations, and so can be interpreted as one mechanism behind them. This is true both at the firm and aggregate level, where the latter depends crucially on the existence of a common component to beliefs. Further, we show that, across countries, the relationship between return correlations and the volatility of macroeconomic factors that typically drive discount factors in structural models is rather weak, suggesting that observable macroeconomic shocks are not a major factor at play. As a last exercise, we control for the effects of a number of additional risk factors that have been shown to be important in asset pricing (as well as for fluctuations in the pure rate of time preference) by regressing firm-level returns on these factors and examining the correlation of the residuals. Although these factors appear to play some role, excess comovement remains, further suggesting that an information-based mechanism deserves scrutiny.

Finally, we examine the robustness of our results to controlling for a number of additional alternative explanations. Specifically, we perform two sets of regression analyses: first, we regress the empirical levels of return correlation directly on analyst forecast correlations (and fundamental correlations) across countries. We find a strong direct relationship. We then control for a variety of plausible alternatives suggested in the literature, including institutional quality and firm-level transparency, capital account openness, and the depth of financial markets. The significance of forecast correlations remains high even after the inclusion of these other factors, confirming the importance of our mechanism. An analogous exercise with aggregate stock market volatility as the regressand gives similar results. Note that this is not to say that other factors play no role; only that the importance of the correlation in beliefs that we measure does not vanish with their inclusion. Lastly, we show that forecast correlations themselves are significantly related to some of these measures, with the interpretation that in some sense, many of these explanations are complementary to ours.

The paper is organized as follows. After reviewing the related literature next, Section 2 describes our data sources and documents the motivating facts. Section 3 lays out our model of equity markets with imperfect and correlated information, while Section 4 details our numerical exercise and results. In Section 5, we demonstrate the robustness of our findings to a number of variants on our baseline approach and to controlling for plausible alternatives. We conclude in Section 6. For ease of exposition, tables of country-level data are provided in the Appendix. All supplementary empirical results discussed but not reported are available on request from the authors.

1.1. Related literature

Our paper relates most closely to the existing literature that examines firm-level stock return comovement. Particularly relevant is the body of work that specifically investigates correlated information as a potential cause of return comovement. Veldkamp (2006) demonstrates that a noisy rational expectations model featuring endogenous information markets can lead to excess comovement – in equilibrium, investors purchase common information about a subset of assets that they use to price others. Although our model differs on a number of dimensions from hers, we are able to draw some parallels in terms of predictions for excess comovement. Our work builds on hers by directly measuring the correlation in beliefs on the part of informed investors and investigating further the quantitative significance of this channel for return comovement, as well as the implications for the cross-section of

¹ See, for some examples, Durnev et al. (2003), Hou et al. (2013), Dasgupta et al. (2010), and Lee and Liu (2011). Dang et al. (2014) contains a useful overview of the state of the literature.

² We review the related literature at the end of this section.

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