Diagnostic Expectations and the Macroeconomy*

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Abstract

We derive the theoretical predictions of diagnostic expectations regarding the transmission of sentiment to investment, employment, income, productivity, and consumption under imperfect information. We show and verify that, unlike rational expectations, diagnostic expectations predict short-term overreaction and subsequent reversals particularly in economies characterized by lower financial sophistication. These effects are stronger when macroeconomic uncertainty is high and sentiment volatility is low. Using novel measures of sentiment and uncertainty extracted from US news articles, we find evidence consistent with these predictions both in the cross-section of OECD countries and the time series in the US.

JEL classification: E20, G41, F36, F43.

Keywords: diagnostic expectations; overreaction; reversals; effect of sentiment on the economy.

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I. INTRODUCTION

A burgeoning literature addresses the macroeconomic implications of diagnostic expectations. Gennaioli and Shleifer (2010) posit that agents overweigh the probability of future events that are similar to current events, leading to over-extrapolation through the well-known representativeness heuristic (Tversky and Kahneman (1983)). Bordalo *et al*. (2020) introduce a diagnostic Kalman filter, defined as a rational Kalman filter modified to include diagnostic expectations, to analyze how forecasts react to news. L'Huillier *et al*. (2024) build on this setup to analyze how beliefs about a hidden productivity component shape macroeconomic fluctuations. Their model shows that expectations taken through a diagnostic Kalman filter lead to overreaction, a finding also consistent with previous theoretical studies on sentiment and growth (Bordalo *et al*. (2018), Bordalo *et al*. (2022), Bianchi *et al*. (2024), Bordalo *et al*. (2024), Maxted (2024)).

We contribute to this literature in two ways. On the theoretical side, we derive several novel predictions of how diagnostic expectations affect the macroeconomy. We show that diagnostic expectations, unlike rational expectations, predict short-term overreaction and subsequent reversals, particularly in economies that are characterized by lower financial sophistication. On the empirical side, we test these predictions not only in the US, the largest and most advanced economy in the world, but also in a rich cross-country data set from the OECD. In so doing, we are able to identify the transmission mechanism of diagnostic expectations to the real economy by exploiting variation in country-level characteristics of interest, such as financial development (*e.g*., Rajan and Zingales (1998)). To the best of our knowledge, our paper is the first to find evidence that real-world macroeconomic fluctuations are consistent with economic agents using a diagnostic Kalman filter in forming their expectations.

In our theoretical analysis, we consider an economy with a Cobb-Douglas production function and a representative agent. Productivity is stochastic and we refer to its volatility as macroeconomic uncertainty. Agents do not observe the state of the economy but estimate it with a noisy signal. This noise component, which we refer to as sentiment, is also stochastic. Therefore, sentiment exhibits volatility in its own right.

Following Bordalo *et al*. (2020), we propose a model of diagnostic expectations in which agents use the Kalman filter to take into account the full history of past signals. We model such expectations as the weighted sum of a rational component and an overreaction term, deriving

corresponding predictions for macroeconomic outcomes. Diagnostic expectations predict that high sentiment increases macroeconomic growth. The effect, however, is crucially moderated by macroeconomic and sentiment volatility. Specifically, macroeconomic growth is increasing in the former and decreasing in the latter. The intuition is that agents rely more on sentiment when their subjective evaluations are more precise and when macroeconomic fundamentals are harder to assess. If the initial overreaction is sufficiently strong, the model predicts a subsequent reversal.

We test these predictions in cross-sectional, panel, and time-series regressions. In the first part of the analysis, we consider cross-country data from the OECD to test the model's cross-sectional predictions. Our dependent variable for these tests is the sensitivity of country-level investment to sentiment, either contemporaneous (identifying overreaction) or lagged (identifying reversals). The independent variables are our empirical analogs to the volatility of the macroeconomic and the sentiment signals. To identify the former, we use the variance of country-level growth of either GDP or consumption. For the latter, we consider the variance of country-level consumer confidence indices from the OECD. Consistent with the model predictions, we find that the magnitude of the sensitivity of the country-level investment to sentiment is positively related to macroeconomic volatility and negatively related to sentiment volatility.

We also test our main model predictions in a panel setup, studying how the effect of sentiment on cross-country macroeconomic growth is moderated by macroeconomic uncertainty and sentiment volatility. Our primary measures of sentiment and uncertainty are text-based and obtained from US news articles. This approach has two advantages. First, we estimate these measures using the same set of US economic news articles. In so doing, we jointly identify the first and second moments of economic beliefs embedded in such articles. This is in contrast with previous literature which estimates these separately, thereby raising issues of comparability. Second, we are able to include a large set of foreign countries in the analysis, independently of the availability of local sentiment measures.

Our identifying assumption is that US sentiment plays an important role in shaping sentiment in foreign countries (*e.g.*, Baker *et al*. (2012), Montone and Zwinkels (2020)). In preliminary analysis, we find evidence consistent with this conjecture. Our US-based measures of sentiment and uncertainty exhibit strong correlation with their local counterparts, where available. Our measures are also highly correlated with several pre-existing indicators of US sentiment and

uncertainty. In particular, our uncertainty index co-moves with the VIX and spike during NBER recessions, whereas the sentiment index tends to follow the opposite pattern. These tests provide validation to our identification of sentiment and uncertainty.

Consistent with the results from the cross-sectional regressions, we find that high US sentiment in times of high US macroeconomic volatility leads to overreaction and subsequent reversals for a number of local macroeconomic outcomes, including income, consumption, investment, and unemployment. We also provide more direct evidence that the mechanism we propose identifies changes in economic expectations. We show that a joint increase in sentiment and uncertainty is associated with a contemporaneous increase and a subsequent downward revision in local GDP forecasts. In additional tests, we find similar results for a number of local measures of sentiment and uncertainty, indicating that our estimates are robust to alternative definitions of our variables of interest.

We further identify the mechanism underlying our results by exploiting cross-country variation in financial development and capital flows. Countries that exhibit a lower degree of financial development are characterized by a more limited availability of fundamental information and, correspondingly, less sophisticated investors (Baker and Wurgler (2006, 2007), Benhabib *et al*. (2016), Bartram and Grinblatt (2021), Constantinides *et al*. (2025)). As a result, we expect more reliance on the representativeness bias in these countries, leading to stronger overreaction and subsequent reversals. Consistent with this conjecture, we find that our estimates are indeed more pronounced in countries that are less financially developed. We find similar results also for GDP forecasts, further corroborating our hypothesis that expectations play a key role in shaping these patterns. Finally, we show that the results are stronger for countries that receive more investment from the US, but not for countries that invest more in the US, consistent with our identifying assumption that US sentiment and uncertainty spill over to foreign countries.

Previous macroeconomic literature on sentiment largely focuses on the US. For the sake of comparability, in the last part of the analysis we test our theoretical predictions using the time series of US macroeconomic data. Again, we find results consistent with our theoretical predictions. An increase in sentiment in times of high uncertainty is associated with overreaction and subsequent reversals in US macroeconomic outcomes. The results hold with the opposite sign in times of high sentiment volatility, and again seem to reflect shifts in economic expectations.

The paper proceeds as follows. In Section II, we discuss related literature and further highlight our contribution. In Section III, we introduce our theoretical predictions for investor expectations and macroeconomic outcomes. In Section IV, we describe our data and methods. In Section V, we present and discuss our empirical findings for the OECD countries. In Section VI, we analyze US data. In Section VII, we offer concluding remarks.

II. RELATED LITERATURE

Our paper makes several contributions to the literature. Constantinides *et al*. (2025) show that sentiment is a catalyst for productivity and economic growth in a large cross-section of countries, contributing to the creation of business cycles. They find evidence for two transmission mechanisms. First, sentiment relaxes financial constraints by raising equity prices and increasing aggregate investment. Second, sentiment creates a boom in aggregate demand through an increase in consumption and employment. In this paper, we show that diagnostic expectations likely affect the real economy through the same two channels. Furthermore, our identification of sentiment through textual analysis is more granular and allows us to directly identify the narratives underlying belief formation (Shiller (2017)).

Bianchi *et al.* (2024) analyze how diagnostic expectations shape professional forecasts about a range of macroeconomic outcomes, finding overreaction to news, particularly when uncertainty is high. In contrast to Bianchi *et al.* (2024) who emphasize the theoretical foundations of diagnostic expectations and their relationship to uncertainty, our paper examines the cross-country macroeconomic consequences of these expectations. We find, for example, that the influence of diagnostic expectations on macroeconomic outcomes is more pronounced in countries with less developed financial markets, thereby highlighting a novel overarching role of the financial system in shaping economic expectations.

Na and Yoo (2025) show that a diagnostic expectation model for a small open economy outperforms its rational expectations counterpart in explaining Argentine macro-international data, better capturing the volatility and cyclicality specific to emerging countries. Conversely, we propose a single-country model and use a large cross-section of (mostly) developed countries to test its novel cross-sectional predictions for diagnostic expectations. Cao and L'Huillier (2018) calibrate a state-space model to identify shocks to long-run income and find evidence of long-run

reversals. In our paper, we use regression analysis to empirically identify short-term shocks to income (and other macroeconomic aggregates) and subsequent reversals. Our results complement theirs as we identify delayed learning at shorter time horizons.

Baker and Wurgler (2006, 2007) show that when there is uncertainty about firm-level fundamentals, investors hold a wider range of subjective valuations that increase misallocation of capital. Birru and Young (2022, 2023) find that this result holds more generally under high aggregate uncertainty, leading to greater mispricing and higher aggregate investment. Polk and Sapienza (2009) show that high sentiment can make it optimal for managers to invest in projects of lower quality, as a form of market timing, especially in the presence of large information asymmetries between managers and investors. Our results suggest that this mechanism is enhanced when macroeconomic uncertainty is high and sentiment volatility is low, leading to overinvestment and subsequent reversals both in the US and in foreign countries.

Brunnermeier *et al*. (2021) argue that the identification of economic expectations through textual analysis represents a promising alternative to survey-based measures, due to its higher granularity and correspondingly lower noise. For example, Baker *et al*. (2016) provide a credible identification of economic policy uncertainty using textual analysis from US news articles. In this paper, we follow their methodology to extract two related but different measures. First, we identify economic uncertainty of a more general nature, rather than uncertainty specifically related to economic policy. Second, we identify economic sentiment, using the well-established algorithm of Loughran and McDonald (2011).

Our results provide support to an emerging literature establishing a link between economic growth and text-based measures of sentiment (Shapiro *et al*. (2022), Bybee *et al*. (2024), van Binsbergen *et al*. (2024)) and uncertainty (Baker *et al*. (2016), Gulen and Ion (2016), Hassan *et al*. (2019)). Our contribution to this literature is twofold. First, we estimate measures of text-based sentiment and uncertainty from the same set of US economic news articles. This approach allows us to jointly identify the first and second moments of economic beliefs embedded in such articles. Conversely, previous literature estimates those separately, typically using different methodologies and data sources, raising issues of comparability. Second, we consider a large number of foreign countries in addition to the US. This cross-country dimension allows us to shed light on the mechanism through which belief formation affects economic growth.

Alternative models of expectations, not addressed in this paper, include extrapolative expectations (Bacchetta *et al*. (2009), Amromin and Sharpe (2014), Greenwood and Shleifer (2014), Barberis *et al*. (2015, 2018), Giglio *et al.* (2021)), expectations sensitive to extreme events (Kozlowski *et al*. (2019, 2020)), expectations characterized by rational inattention and frictions (Angeletos and Lian (2016, 2022, 2023), Gabaix (2019)), and expectations with fading memory (Nagel and Xu (2022)).

Bordalo *et al*. (2022) show that using diagnostic expectations provides two key advantages relative to alternative theories. First, these expectations are forward-looking and respond to current changes in the environment. As a result, there is no need to assume a specific data-generating process. Second, diagnostic expectations and be identified in empirical data through surveys or forecasts. These advantages, and particularly the first one, are especially important for our empirical setup. They imply that the breakdown of sentiment into an economic and an orthogonalized component, which is essential in other sentiment literature (e.g., Constantinides *et al*. (2025)), is not as relevant in our study because agents with diagnostic expectations overreact to rational signals. We formalize this point in the model below.

III. THE ECONOMY, EXPECTATIONS, AND SENTIMENT

III.1 The Economy

We consider a production economy with a Cobb-Douglas function $e^{\mu+\theta_t} I_t^{\alpha} L_t^{\beta},\ 0 < \alpha + \beta < 1$, and a representative agent. The inputs are investment I_t and labor L_t. The total factor productivity $e^{\mu+\theta_t}$ is a function of the state of the economy θ_t, which evolves as an AR (1) process $\theta_t = \rho\theta_{t-1} + \varepsilon_{\theta,t},\ \varepsilon_{\theta,t}\ i.i.d.,\ \varepsilon_{\theta,t} \sim N(0, \sigma_\theta^2)$. We call σ_θ^2 the *macroeconomic uncertainty*. Investors do not observe the state of the economy but, instead, estimate it as $\widehat{\theta_t}$ by observing a signal s_t, where $s_t = \theta_t + \varepsilon_{s,t},\ \varepsilon_{s,t}\ i.i.d.,\ and\ \varepsilon_{s,t} \sim N(0, \sigma_s^2)$. We call s_t *sentiment*. The error terms $\varepsilon_{\theta,t}, \varepsilon_{s,t}$ are uncorrelated. The model implies that optimal investment, optimal employment, and GDP are increasing in $\widehat{\theta_t}$. By introducing the consumption decision as in Bianchi *et al*. (2024), the model further implies that aggregate consumption is increasing in $\widehat{\theta_t}$.

III.2 Expectations

Rational investors infer the state of the economy at time *t* by applying a Kalman filter to the history of signals as

$$\widehat{\theta_t} = \theta_t^{rational} = \rho \frac{\Sigma^{-1}}{\Sigma^{-1}+\sigma_s^{-2}} \theta_{t-1}^{rational} + \rho \frac{\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}} s_t. \quad (1)$$

Parameter Σ is the conditional variance of θ_t, calculated as the positive root of the quadratic equation $\Sigma = \rho^2 \frac{1}{\Sigma^{-1}+\sigma_s^{-2}} + \sigma_\theta^2$. The inferred state of the economy $\theta_t^{rational}$ weighs the lagged inference $\theta_{t-1}^{rational}$ and the signal s_t by their respective precisions Σ^{-1} and σ_s^{-2}. The response of the inferred state of the economy to the contemporaneous signal is $\partial\hat{\theta}_t/\partial s_t = \frac{\rho\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}}$. In the appendix, we prove that the effect of the contemporaneous signal on the inferred state of the economy is positive, decreasing in $var(s_t)$, and increasing in σ_θ^2. At the limit, the signal fully reveals the state when its volatility approaches zero. The effect of the lagged signal on the inferred state of the economy is also positive and equal to $\partial\hat{\theta}_t/\partial s_{t-1} = \frac{\rho\Sigma^{-1}}{\Sigma^{-1}+\sigma_s^{-2}} \frac{\rho\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}}$, indicating that rational expectations do not predict overreaction and subsequent reversals. This prediction contrasts with the diagnostic expectations framework we develop below.

Following Bordalo *et al.* (2020), we adopt a model of diagnostic expectations in which agents use the Kalman filter to take into account the full history of past signals. We model such expectations as the sum of a rational component and an overreaction term $\frac{\eta}{\Sigma^{-1}+\sigma_s^{-2}}\left(s_t - \theta_{t-1}^{diag}\right)$ as $\widehat{\theta_t} = \theta_t^{diag} = \frac{\rho\Sigma^{-1}-\eta}{\Sigma^{-1}+\sigma_s^{-2}} \theta_{t-1}^{rational} + \frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}} s_t$, where η is the degree of overreaction. In the appendix, we prove that $\partial\hat{\theta}_t/\partial s_t = \frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}}$. The effect of the contemporaneous signal on the inferred state of the economy $\frac{\partial\hat{\theta}_t}{\partial s_t}$ is positive, decreasing in $var(s_t)$, and increasing in σ_θ^2. This implication is the same as the corresponding implication with rational expectations. What is novel is the effect of the lagged signal on the inferred state of the economy. It is $\partial\hat{\theta}_t/\partial s_{t-1} = \frac{\rho\Sigma^{-1}-\eta}{\Sigma^{-1}+\sigma_s^{-2}} \frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}}$ and is a reversal if the initial overreaction is sufficiently strong, $\eta > \rho\Sigma^{-1}$.

III.3. Predictions

The model of diagnostic expectations predicts that high sentiment increases macroeconomic output through investment and labor. In the appendix, we show that this effect is decreasing in the

variance of the sentiment signal $var(s)$ and increasing in the variance of the macroeconomic signal σ_θ^2. If the initial overreaction is sufficiently strong, the model predicts a subsequent reversal. This mechanism should be more pronounced for economies in which agents are more prone to biases, such as representativeness, implying larger values of η.

We first test these predictions in a cross-section of countries from the OECD, estimating average values across time of $var(s)$ and σ_θ^2. We then test these predictions in panel data for the OECD and in time series data for the US. Even though the model assumes constant $var(s_t)$ and $\sigma_{\theta,t}^2$ for a given country, we test in a time series whether the contemporaneous signal is decreasing in the variance of the sentiment signal $var(s_t)$ and increasing in the variance of the macroeconomic signal $\sigma_{\theta,t}^2$. We also test for reversals.

IV. DATA DESCRIPTION

US sentiment and uncertainty

In the spirit of Baker *et al*. (2016), we build text-based measures of sentiment and uncertainty by looking at coverage frequency in US news articles. We obtain data on ten leading newspapers from ProQuest: Atlanta Journal-Constitution, Boston Globe, Chicago Tribune, Los Angeles Times, New York Times, Newsday, Star Tribune, USA Today, Wall Street Journal, and Washington Post. For each newspaper, we identify economic news articles by searching for "economic," "economy," and "economics" within each available article. To identify sentiment in a news article, we utilize the dictionary from Loughran and McDonald (2011). The sentiment score for each article is simply the difference in relative frequency between positive and negative words. As for uncertainty, we count the frequency at which the words "uncertain" or "uncertainty" appear in each article.

One caveat with raw counts is that the overall volume of articles in general, and economic articles in particular, varies across both newspapers and time. To address this issue, we scale the raw counts by the total number of economic articles in the same newspaper and month. In so doing, we obtain a monthly series for economic sentiment and uncertainty for each newspaper whose values can be compared over time. Finally, we standardize our variables of interest so that each newspaper-level series has zero mean and unit standard deviation during the sample period, and

average values across the ten newspapers into aggregate monthly indices of US economic sentiment and uncertainty. The data is available from 1985 Q1 to 2021 Q4.

To validate our measures, we study a wide set of correlations with pre-existing measures of sentiment and uncertainty. We find that our index of economic sentiment is positively correlated to other measures of US sentiment, such as the consumer confidence index (0.63, p-value < 0.0000), the text-based index of economic sentiment in Bybee *et al.* (2024) (0.64, p-value < 0.0000), and the investor sentiment index in Baker and Wurgler (2007), although the latter is not significant (0.13, p-value > 0.1000). In Figure 1, we report the distribution of pairwise correlation coefficients between our measure of sentiment and country-specific consumer confidence indices. Most correlations are positive and large.

Our index of economic uncertainty is also positively correlated with other uncertainty measures for the US, such as the economic policy uncertainty index in Baker *et al*. (2016) (0.89, p-value < 0.0000), the index of total macroeconomic uncertainty in Ozturk and Sheng (2018) (0.44, p-value < 0.0000), the index of macroeconomic uncertainty in Jurado *et al*. (2015) (0.61, p-value < 0.0000), and the VIX (0.41, p-value < 0.0001). In Figure 2, we report the distribution of pairwise correlation coefficients between our measure of uncertainty and country-specific total macroeconomic uncertainty. Again, most correlations are positive and large.

In Figure 3, we plot our measures of economic sentiment and uncertainty over time. As expected, uncertainty tends to spike during NBER recessions while sentiment plummets. Also, uncertainty follows a similar pattern to the VIX index, further indicating that it captures uncertainty both in the real and the financial economy. Overall, these analyses provide validation to our measures of economic sentiment and uncertainty.

OECD data

Table 1, Panel A, presents quarterly summary statistics for the OECD data. The main macroeconomic outcomes of interest are income (real GDP), consumption growth (real personal consumption expenditures), investment growth (real capital formation), and unemployment

(change in the unemployment rate). The original data set includes 41 countries, excluding the US. However, we observe our full set of local macroeconomic variables for 34 of these countries.[1]

The average quarterly rates of growth are 0.62% for GDP, 0.65% for consumption, and 0.78% for investment, whereas the average unemployment rate is 8.06%. In addition to country-level macroeconomic outcomes, we also consider local measures of financial development from Rajan and Zingales (1998), including stock market capitalization, stock market trading, total domestic credit, and total monetary credit, all scaled by real GDP, and real GDP per capita, retrieved from the World Bank database.

We estimate our financial development measures as averages over the period 1975-1990 to smooth out the potential confounding effect of booms or busts of the financial system and address potential endogeneity concerns in the empirical analysis that follows (*e.g.*, Rajan and Zingales (1998), Pagano and Pica (2012), Montone and Zwinkels (2020)). For the economies in our sample, the average size of their financial system relative to GDP is equal to 33.1% for market capitalization, 13.0% for stock market trading, 62.1% for domestic credit, and 51.7% for monetary credit, implying slightly higher reliance on debt than equity, whereas average real GDP per capita is 19.905 in constant 2015 US dollars. These averages indicate moderate to high levels of financial development, especially for the banking system, as expected for OECD countries.

Finally, we consider several measures of capital flows to and from the US. First, we consider foreign direct investments (FDIs) from the Bureau of Economic Analysis. The average US-bound FDIs for the countries in the OECD sample, relative to their GDP, is equal to 0.57%. The FDIs that they receive from the US, relative to their GDP, are slightly higher and equal to 0.73%, consistent with the US playing a leading role in the world economy especially through FDIs (Albuquerque *et al*. (2005)). Second, we consider portfolio investments (PIs) from the US, retrieved from the International Monetary Fund's Coordinated Portfolio Investment Survey. The average level of PIs from the US, relative to local GDP, is equal to 1.07% for equity PIs and 1.52% for total PIs. Overall, the data on capital flows indicates that the US economy plays an important role in the local economies of the countries in our sample.

[1] The countries are Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Poland, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, and United Kingdom.

US data

Table 1, Panel B, presents summary statistics for the US. The average quarterly rates of growth are equal to 0.64% for GDP, 0.73% for investment, and 0.59% for consumption. These numbers are similar to those from the OECD, reflecting the fact that the countries from the OECD data set are mostly developed. The average quarterly unemployment rate is 5.88%, and therefore slightly lower than its OECD counterpart. Among other macroeconomic variables of interest, the average quarterly growth rate of industrial production is 0.42% and average inflation is 0.69%. Our text-based measures of US economic sentiment and uncertainty are standardized and therefore exhibit zero mean and unit variance. The interquartile range is between -0.45 and 0.61 for standardized economic sentiment and between -0.68 and 0.43 for standardized macroeconomic uncertainty.

V. CROSS-COUNTRY ANALYSIS

Cross-sectional tests

We begin the empirical analysis by testing the model's cross-sectional predictions. To this end, we turn to our cross-country sample from the OECD. For each country in our sample, we run a time-series regression of country-level capital formation growth on text-based US sentiment innovations, controlling for the US fundamentals from Ludvigson and Ng (2009). We call these regression coefficients as the country-specific sentiment betas. The betas are positive and highly significant for most countries. In the online Appendix A1, we show that the effect of sentiment on macroeconomic expectations, particularly the degree of overreaction, is symmetric across different investment states.

Next, we run a cross-sectional regression of the country-level sentiment betas on our empirical analogs to the volatilities of the macroeconomic and the sentiment signals. To identify the former, we use the variance of country-level growth of either GDP or consumption. As for the latter, we consider the variance of country-level consumer confidence indices from the OECD. We use local measures of sentiment and uncertainty for these tests because our main measures are US-based, and therefore equal for all countries. Using local measures then allows us to obtain cross-sectional variation for our empirical tests. In these regressions, all variables are expressed in logs and standardized to ease the interpretation of the results.

We first use an extended sample that includes the entire set of non-US countries from the OECD, with the only exception of China for which our variables of interest are unavailable. The number of countries, and therefore the number of observations for the associated cross-sectional regressions, rises to 40 (adding Brazil, India, Indonesia, Portugal, Russia, and South Africa to our main data set). For reasons of consistency, we also repeat the analysis in the same subsample of 34 countries for which all macroeconomic variables are available, which we use in our panel regressions below. We refer to the latter as the "restricted" sample.

The results are in Table 2, Panel A. We start the analysis using macroeconomic volatility as the only regressor. The coefficient of interest is positive and highly significant. Next, we introduce the empirical analog to the volatility of the sentiment signal using local sentiment. By considering the volatility of both signals simultaneously, we can interpret the latter as the impact of the volatility of the sentiment signal unrelated to macroeconomic volatility. The coefficient of macroeconomic volatility is still positive and significant whereas the coefficient of the volatility of sentiment is negative and significant. These findings are consistent with diagnostic expectations.

Finally, we test the model predictions on the speed of declining sensitivity. To this end, we estimate a time-series regression separately for each country of one-step-ahead country level capital formation growth on text-based US sentiment innovations controlling for US fundamentals. The sentiment betas from these regressions are mostly negative and significant, consistent with the economic reversals we observe in the analysis that follows. Then we use these betas as the dependent variable for regressions on the two volatilities introduced above.

The results are in Table 2, Panel B. Interestingly, the signs flip with respect to the contemporaneous analysis, indicating that the absolute value of reversals are increasing in the volatility of the macroeconomic signal and decreasing in the volatility of the sentiment signal. This result is again consistent with diagnostic expectations.

A potential concern is that the volatility of sentiment may capture non-linearities related to the average level of sentiment in our countries. To address this issue, we re-estimate both sets of cross-sectional regressions controlling for the mean and squared mean of sentiment. The estimates, reported in the online Appendix A2, are robust to this alternative specification. Our coefficients of interest are virtually unchanged in both magnitude and significance.

Panel regressions

We also test our main model predictions in a panel setup. We first study the effect of the US-based measures of sentiment and uncertainty on macroeconomic growth in foreign countries. In additional tests, we exploit variation in some country-specific characteristics of interest, which allows us to identify proxies for the volatility of sentiment signals at the country level and also increase the statistical power of our tests. The mechanism underlying our empirical design is the prominent role that the US plays in the foreign economies and financial markets. With this in mind, we analyze how the text-based measures of US economic sentiment and uncertainty affect macroeconomic growth in foreign countries. We therefore exclude the US from the analysis.

In these regressions, we use a rich set of controls. We consider the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of the local macroeconomic variables of interest, sentiment, and uncertainty. We also include country, quarter, and country times quarter fixed effects to account for the potential confounding effect of any residual seasonality patterns (global or country-specific) and time-invariant country-level characteristics.

With country fixed effects, our identification relies on within-country variation in our variables of interest. Therefore, we express sentiment in levels in these empirical tests. In particular, we consider the average level of sentiment during the quarter. We do not consider end-of-quarter values because sentiment takes time to shape macroeconomic outcomes, and quarterly averages help us smooth out potential noise embedded in the monthly sentiment realizations (Constantinides *et al*., 2025). One potential concern with this choice is that average sentiment may partly reflect contemporaneous economic growth. However, the inclusion of an extensive vector of current and past macroeconomic fundamentals moderates this concern.

The results are in Table 3, Panel A. We find that a one-standard-deviation joint increase in US economic sentiment and uncertainty is associated with an increase in the quarterly rate of growth of local GDP (0.26%), consumption (0.35%), and investment (0.20%), and a decrease, although of small magnitude, in unemployment (-0.03%). These results are consistent with both rational and diagnostic expectations.

US versus local sentiment

We repeat the analysis with measures of local sentiment and uncertainty to see if the results also hold for country-specific beliefs. We first consider pre-existing measures of local sentiment and

uncertainty, such as the country-level consumer confidence index from the OECD and the index of total macroeconomic uncertainty from Ozturk and Sheng (2018), available for the period from Q4 1989 through Q4 2020 for all the countries in our sample. The results are in Table 3, Panel B. We find that a joint one-standard-deviation increase in local economic sentiment and uncertainty is associated with an increase in the quarterly rate of growth of 0.27% for foreign GDP, 0.29% for consumption, 0.25% for investment, and a decrease of 0.07% in unemployment. The signs and magnitudes are therefore close to those from the analysis of US sentiment and uncertainty.

We also run horse races between these local measures and our US-based measures. In so doing, we test whether our main results are indeed driven by US (or global) sentiment and uncertainty. The results are in Table 3, Panel C. We find that both the US and the local channel retain their explanatory power. A joint one-standard-deviation increase in US economic sentiment and uncertainty is associated with an increase in the quarterly rate of growth of 0.28% for foreign GDP, 0.33% for consumption, 0.27% for investment, and a decrease of 0.02% in unemployment. These estimates are similar and respectively equal to 0.22%, 0.24%, 0.16%, and -0.06% for the local measures of sentiment and uncertainty. In the online Appendix A3, we find that these results are robust to using alternative text-based definitions of local sentiment and uncertainty.

Reversals

Next, we test for the presence of reversals for the panel analysis. Rather than focusing on individual quarters, we consider one-year-ahead cumulative macroeconomic growth, defined as the sum of the rates of growth over future quarters t+1 through t+4 (one year ahead). This approach helps smooth out potential noise and volatility that might be present in quarter-by-quarter growth figures, providing a more robust measure of the overall growth trend. We also consider two-year-ahead cumulative growth, from quarters t+5 through t+8, to examine longer-term reversals. The estimates are in Table 4. The results indicate that by and large, reversals mostly take place within one year. The findings lend support to the theoretical predictions of diagnostic expectations. Conversely, they are inconsistent with the predictions of the rational expectations model. We further shed light on these results in the analysis of financial development below.

Economic expectations

We also provide a direct test of our theoretical prediction that sentiment affects expectations. We analyze the impact of sentiment on local GDP forecasts. High sentiment should be positively

associated with optimistic expectations over future growth, followed by a downward revision, especially so when macroeconomic volatility is high. The estimates are in Table 5, Panel A. Consistent with our conjecture, we find that a joint one-standard-deviation increase in US sentiment and uncertainty is associated with a contemporaneous increase in GDP forecasts of 1.37%, and a subsequent downward revision of 1.54% over the following year, whereas the effect vanishes two years ahead. We find a similar empirical pattern in Panel B, where we consider local measures of sentiment and uncertainty. Altogether, these results support the interpretation of our earlier findings as shifts in economic expectations, reflecting variation in sentiment and the volatility of economic signals.

Financial development

To further tease out the predictions of the models with rational and diagnostic expectations, we exploit cross-sectional variation in country-level financial development. Our priors are as follows. Previous literature shows that financially developed systems have a superior ability to aggregate information in both financial markets and the real economy (Rajan and Zingales (1998), Constantinides *et al*. (2025)). As a result, more developed financial systems are characterized by a greater availability of fundamental information and comparatively more sophisticated investors (Baker and Wurgler (2006, 2007), Benhabib *et al*. (2016), Bartram and Grinblatt (2021), Constantinides *et al*. (2025)). Correspondingly, agents in these countries should be less prone to biases such as representativeness, which is the underpinning of diagnostic expectations. Therefore, overreaction should be less pronounced in financially developed countries, and followed by more muted reversals. Following this line of reasoning, we effectively identify cross-sectional variation in the parameter η from the model.

These predictions differ from those of rational expectations in two important ways. First, agents who rationally use a Kalman filter do not overweight the current signal, unlike diagnostic expectations, implying no overreaction. Therefore, according to the rational model, we should observe no cross-sectional variation in the effect of sentiment on growth based on investor sophistication (proxied by financial development), because agents are fully rational and not prone to biases. Second, rational expectations do not predict reversals, independently of the degree of financial development.

To test these predictions, we consider several measures of financial development from Rajan and Zingales (1998), including stock market capitalization, stock market trading, total domestic credit, and total monetary credit, all scaled by real GDP, and GDP per capita. We estimate them as averages over the period 1975-1990 to smooth out the potential confounding effect of booms or busts of the financial system (*e.g.*, Rajan and Zingales (1998), Pagano and Pica (2012), Montone and Zwinkels (2020)). Then we re-estimate our test equation in the post-1990 subsample by interacting our US text-based measures of sentiment and uncertainty with these indicators of financial development. Our identifying assumption is that these indices capture the degree of country-level financial sophistication (Rajan and Zingales, 2003), and less sophisticated investors are more prone to behavioral biases (Hirshleifer and Teoh, 2003; Feng and Seasholes, 2005). We consider real GDP growth as our main dependent variable for these tests, as it represents a comprehensive measure of country-level economic growth.

The results are in Table 6, Panel A. Consistent with our previous findings, the estimates indicate that a joint one-standard-deviation increase in sentiment and uncertainty is associated with higher GDP growth. However, this result is crucially mediated by a country's degree of financial development, as expected. A one-standard-deviation increase in financial development significantly decreases the magnitude of the effect of sentiment and uncertainty on economic growth. The results are similar in both magnitude and significance for each of the five measures of financial development, thereby lending further empirical support to the predictions of the diagnostic expectations model.

We also revisit our results on reversals in a fully interacted model with financial development. The results are in Table 6, Panel B. We find that reversals are stronger for less financially developed countries, as expected, thereby mirroring the results in Panel A. Economies in which the sentiment effect is stronger are also those in which the effect reverts more quickly, consistent with diagnostic expectations. Sentiment then seems to make economic growth more volatile in these countries.

Our model also predicts that the magnitude of the sentiment effect should decrease with the volatility of sentiment signals. In this empirical setup, we identify the latter as the standard deviation of sentiment, estimated over a moving window of 40 quarters to ensure enough observations. The estimates, reported in the online Appendix A4, provide further support to our

theoretical predictions. We find that a joint one-standard-deviation increase in sentiment and its volatility is associated with a decrease in the quarterly rate of growth of GDP and a subsequent reversal. As expected, the magnitude of the effect decreases with a country's degree of financial development.

Finally, we analyze whether this mechanism also applies to expectations, as implied by our model. To this end, we repeat the analysis replacing GDP growth with GDP forecasts. The results, reported in Table 7, lend support to our theoretical predictions. We find that a joint increase in sentiment and macroeconomic volatility is generally associated with more optimistic forecasts and more pronounced forecast reversals in economies with lower financial development.

Capital flows

As a second potential transmission mechanism of US sentiment and uncertainty to foreign economies, we consider capital flows to and from the US. To this end, we consider foreign direct investments (FDIs) and portfolio investments (PIs). The main difference between these measures is that FDIs entail active management of a foreign firm, whereas the main purpose of PIs is the pursuit of a financial gain. We scale these measures by a country's GDP and express the ratio in logs, due to concerns about skewness and nonstationarity of FDIs (Zwinkels and Beugelsdijk (2010)). Scaling by GDP also yields a direct measure of the economic magnitude of FDIs (Albuquerque *et al*. (2005)). Finally, we standardize all capital flow variables to ease the interpretation of the results, and interact them with our variables of interest.

Our priors are as follows. If our results are driven by the beliefs of US economic agents, capital flows from the US should enhance the effect of US sentiment and uncertainty on local economic growth. The results, reported in Table 8, lend support to this conjecture. As in our baseline regressions, a joint one-standard-deviation increase in US sentiment and uncertainty is associated with higher local GDP growth. However, this relation is significantly stronger for countries that receive more FDIs from the US. Conversely, the effect is not mediated by FDIs in the opposite direction, originating in the foreign country and flowing towards the US. The analysis of PIs originated in the US leads to similar results in both magnitude and statistical significance.

Overall, these results support our identification strategy for the cross-country analysis. Our text-based measures of US sentiment and uncertainty explain local economic growth especially in countries that exhibit stronger economic ties with, and specifically capital flows from, the US. More generally, the results provide novel support to the view that the US plays a leading role in the world economy (Harvey (1991), Campbell and Hamao (1992), Kwark (1999), Kim (2001), Lumsdaine and Prasad (2003)), especially through FDIs (Caves (1996), Albuquerque *et al*. (2005), Montone and Zwinkels (2020)).

VI. US ANALYSIS

The earlier literature on sentiment and growth largely focuses on the United States. In the last part of the analysis we test our model's predictions using US macroeconomic data.

Baseline regressions

We begin the analysis by testing our first set of theoretical predictions. The theoretical models we consider predict that economic sentiment should be positively related to economic growth, especially when the volatility of the macroeconomic signal is high. We identify our two key metrics using our text-based indices of economic sentiment and uncertainty. In all empirical tests, both sentiment and uncertainty are standardized to ease the economic interpretation of the results. We also introduce a rich set of macroeconomic controls. We include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009), two lags of sentiment, uncertainty, and our main macroeconomic variables (including inflation), and quarter and time fixed effects to account for any residual seasonality patterns.

The estimates are in Table 9. Consistent with the model predictions, we find that macroeconomic uncertainty crucially mediates the relation between sentiment and macroeconomic growth. While there is indeed a positive association between the two when sentiment is considered as a stand-alone variable (Panel A), the effect is significantly stronger in times of high uncertainty (Panel B). In particular, a joint increase in sentiment and uncertainty by one standard deviation is associated with an increase in the quarterly rate of growth of GDP (0.34%), consumption (0.41%), and investment (0.30%), and a decrease in unemployment (-0.30%). These results are robust to alternative empirical specifications. We obtain similar results when we run our regressions without

controls or fixed effects (online Appendix A5) and for other measures of economic growth (online Appendix A6).

In a related paper, Birru and Young (2023) document a similar joint effect of sentiment and uncertainty on US monthly aggregate investment. They show that the effect is positive both in contemporaneous and predictive regressions for up to three months ahead. Our results indicate that this mechanism also holds at the quarterly frequency and leads more generally to higher economic growth, consistent with our model predictions. These findings suggest that the mechanism we propose does not only relax financial constraints, but also increases aggregate demand through an immediate jump in consumption and employment.

We also test our model prediction on sentiment volatility in this time-series setup. The estimates, reported in the online Appendix A7, provide further support to our theoretical predictions. Finally, we test the model predictions for sentiment beta in the US sample. To this end, we run a time series regression of US capital formation growth on US text-based sentiment innovations akin to the country-specific auxiliary regressions from the OECD analysis. The estimates, reported in the online Appendix A8, indicate that the effect of sentiment on growth is symmetric across different investment states. Altogether, these baseline time-series results mirror those from the panel analysis.

Reversals

We further validate the results by looking at macroeconomic outcomes at longer horizons. Diagnostic expectations predict reversals. The estimates, presented in Table 10, are consistent with this prediction. We find that a joint one-standard-deviation increase in sentiment and uncertainty is followed by a decrease in one-year growth equal to 0.28% for GDP and 0.36% for consumption, and a 0.18% increase in one-year unemployment. The effect is also negative, although not statistically significant, for investment (0.18%). The latter result may indicate that the sentiment effect is muted by rational market timing on the part of managers, who bring forward their investments when stock prices are inflated by sentiment (Constantinides *et al*. (2025)). Conversely, the coefficients of interest are not significant for one-year growth over future quarters *t+5* through *t+8*. The estimates indicate that reversals fully take place within a year from the sentiment shock, similar to the panel analysis with US measures of sentiment and uncertainty.

Economic expectations

In our final test, we repeat the analysis of GDP forecasts for our US sample. The estimates are in Table 11. Consistent with the results from the panel analysis, we find that a joint one-standard-deviation increase in sentiment and uncertainty is associated with a contemporaneous increase in GDP forecasts of 1.30%, and a subsequent downward revision of 1.21% over quarters *t+1* through *t+4*. The coefficient is negative but not significant in quarters *t+5* through *t+8*. These results lend again support to the interpretation of our earlier findings as shifts in economic expectations.

VII. CONCLUDING REMARKS

In this paper, we contribute to the literature on the impact of diagnostic expectations on economic growth. We study the interplay between sentiment and the volatility of economic signals both theoretically and empirically, with a focus on their impact on real economic activity across countries. Using textual analysis of US news articles, we derive granular measures of economic sentiment and uncertainty that allow for a more precise identification of the narratives driving belief formation. While previous studies typically examine sentiment and uncertainty separately, our analysis indicates that these two measures are intertwined.

We show and verify that, unlike rational expectations, diagnostic expectations predict short-term overreaction and subsequent reversals particularly in economies characterized by lower financial sophistication. Furthermore, we show that sentiment has a stronger effect on economic growth when macroeconomic uncertainty is high and sentiment volatility is low. Using novel measures of sentiment and uncertainty extracted from US news articles, we find evidence consistent with these predictions both in the cross-section of OECD countries and the time series in the US. We show that these real effects of sentiment are consistent with the theoretical predictions of diagnostic expectations, where agents rationally consider the full history of past economic signals through a Kalman filter but also overweigh recent signals. As a result, diagnostic expectations explain differences in cross-country economic growth. To the best of our knowledge, our paper is the first to show this result.

Our study also provides novel evidence on the international transmission of US sentiment and uncertainty. We find that these factors significantly influence economic growth in foreign economies. The effect is stronger for countries with less developed financial systems, supporting the idea that overreaction is more pronounced when fundamental information is less available and

agents are correspondingly less sophisticated. We also find stronger results for countries that receive more capital flows from the US, providing novel evidence of sentiment's role in explaining international economic outcomes through spillover effects.

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Table 1. Summary statistics

Quarterly summary statistics for the OECD countries (Panel A) and the US (Panel B). The OECD countries exclude the US. The sample period is from 1985 Q1 to 2021 Q4.

Panel A. OECD countries

	Mean	Std. Dev.	p25	Median	p75
GDP growth	.0062	.0194	0.0015	.0066	.0121
Consumption growth	.0065	.0234	0.0008	.0065	.0126
Investment growth	.0078	.0395	-0.0086	.0081	.0252
Unemployment rate (level)	.0806	.0404	0.0518	.0730	.0970
Unemployment rate (changes)	-.0003	.0051	-0.0027	-.0007	.0013
Market cap to GDP (%)	33.0642	24.0662	14.2228	23.3634	51.0926
Stocks traded to GDP (%)	13.0407	28.9162	2.9667	3.8000	9.2098
Domestic credit to GDP (%)	62.1034	35.7378	38.9124	50.4534	63.7058
Monetary credit to GDP (%)	51.6643	32.8713	30.7900	44.4404	60.2954
GDP per capita	19.9051	13.6865	7.2717	22.6267	26.3693

Panel B. US

	Mean	Std. Dev.	p25	Median	p75
GDP growth	.0064	.0108	0.0040	.0069	.0101
Consumption growth	.0059	.0114	0.0023	.0059	.0093
Investment growth	.0073	.0165	-0.0004	.0079	.0177
Unemployment rate (level)	.0588	.0164	0.0467	.0553	.0685
Unemployment rate (changes)	-.0002	.0088	-0.0020	-.0010	.0003
IPI growth	.0042	.0178	0.0006	.0062	.0113
Durables growth	.0050	.0280	-0.0059	.0026	.0169
Nondurables growth	.0042	.0109	-0.0009	.0051	.0079
Services growth	.0069	.0127	0.0035	.0075	.0105
Inflation	.0069	.0055	0.0047	.0071	.0093
Sentiment	0	1	-0.4553	.1783	.6110
Uncertainty	0	1	-0.6798	-.2119	.4363

Table 2. Cross-sectional regressions

Cross-sectional regressions of sentiment betas on macroeconomic and sentiment volatility in the OECD countries excluding the US. To estimate sentiment betas, we separately run a time-series regression of country-level capital formation growth, either contemporaneous (Panel A) or one step ahead (Panel B) on text-based US sentiment innovations, controlling for the US fundamentals from Ludvigson and Ng (2009). Macroeconomic and sentiment volatility are respectively defined as the variance of country-level GDP growth and consumer confidence. All variables are expressed in logs and standardized to ease the interpretation of the results. In the first two columns, we consider the entire sample. In the last two columns, we consider the subsample of countries for which we observe the full set of macroeconomic variables. The sample period is from 1985 Q1 to 2021 Q4.

Panel A: Contemporaneous regressions				
	Full sample		Restricted sample	
Macroeconomic volatility	0.6456***	0.8777***	0.6404***	0.8605***
	7.45	6.49	5.31	4.70
Sentiment volatility		-0.3402***		-0.3020**
		-2.75		-2.18
Observations	40	40	34	34
R-squared	0.4168	0.4792	0.3477	0.4006
Panel B: Predictive regressions				
	Full sample		Restricted sample	
Macroeconomic volatility	-0.0559	-0.2872***	-0.0977	-0.3501***
	-0.67	-2.84	-1.02	-3.13
Sentiment volatility		0.3391***		0.3464***
		4.84		4.21
Observations	40	40	34	34
R-squared	0.0031	0.0651	0.0069	0.0663

Table 3. Baseline panel regressions for the OECD

Panel regressions of macroeconomic growth in OECD countries, excluding the US, on text-based measures of sentiment and uncertainty obtained from US newspapers, local consumer confidence, and the local index of total macroeconomic uncertainty from Ozturk and Sheng (2018). The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

Panel A: US measures				
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0073**	0.0057	0.0088*	-0.0012***
	2.59	1.57	1.81	-2.82
US Uncertainty	-0.0037	-0.0048	-0.0046	-0.0000
	-1.60	-1.62	-1.28	-0.01
US Sentiment ×	0.0026***	0.0035***	0.0020***	-0.0003***
Uncertainty	5.40	6.07	2.69	-4.24
Observations	3227	3227	3227	3227
R-squared	0.5585	0.5410	0.2098	0.3319
Panel B: Local measures				
	GDP	Consumption	Investment	Unemployment
CCI	0.0132***	0.0162***	0.0166***	-0.0028***
	7.92	7.32	6.70	-7.45
Macro Uncertainty	-0.0210***	-0.0240***	-0.0164***	0.0004
	-3.75	-4.19	-3.26	0.73
CCI × Macro Uncertainty	0.0027***	0.0029***	0.0025***	-0.0007***
	4.90	4.44	2.99	-5.79
Observations	1979	1979	1979	1979
R-squared	0.6208	0.6176	0.2831	0.4403
Panel C: US versus local measures				
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0020	0.0020	-0.0040	-0.0003
	0.96	0.87	-0.82	-0.81
US Uncertainty	-0.0014	-0.0019	-0.0021	0.0002
	-0.85	-1.03	-0.62	0.61
US Sentiment x	0.0028***	0.0033***	0.0027***	-0.0002**
Uncertainty	8.21	9.29	3.98	-2.47
CCI	0.0088***	0.0108***	0.0121***	-0.0025***
	8.62	7.56	4.63	-7.20
Macro Uncertainty	-0.0110**	-0.0132***	-0.0122***	-0.0001
	-2.33	-3.25	-2.83	-0.16
CCI × Macro Uncertainty	0.0022***	0.0024***	0.0016**	-0.0006***
	4.21	3.71	2.04	-3.29
Observations	1954	1954	1954	1954
R-squared	0.7202	0.7235	0.3211	0.4711

Table 4. Reversals for the OECD

Panel regressions of future macroeconomic growth in OECD countries, excluding the US, on text-based measures of sentiment and uncertainty in the US obtained from US newspapers, local consumer confidence, and the local index of total macroeconomic uncertainty from Ozturk and Sheng (2018). Macroeconomic growth is calculated one year ahead in Panel A (quarters t+1 through t+4) and two years ahead in Panel B (quarters t+5 through t+8). The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

Panel A: US measures, one year ahead				
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0128	0.0064	0.0390***	-0.0035
	1.55	0.70	2.79	-1.43
US Uncertainty	-0.0009	-0.0080	0.0153*	0.0012
	-0.16	-1.20	1.85	0.71
US Sentiment ×	-0.0044***	-0.0049***	-0.0045**	0.0003
Uncertainty	-3.69	-3.92	-2.16	0.75
Panel B: Local measures, one year ahead				
	GDP	Consumption	Investment	Unemployment
CCI	0.0080**	0.0082**	0.0322***	-0.0079***
	2.29	2.06	3.84	-6.70
Macro Uncertainty	-0.0181	-0.0175	-0.0335**	0.0073***
	-1.44	-1.33	-2.12	4.06
CCI × Macro Uncertainty	-0.0041***	-0.0060***	-0.0076**	0.0007
	-2.82	-3.43	-2.28	1.60
Panel C: US measures, two years ahead				
	GDP	Consumption	Investment	Unemployment
US Sentiment	-0.0027	0.0141	-0.0168	-0.0009
	-0.24	1.17	-0.98	-0.26
US Uncertainty	-0.0020	0.0015	-0.0038	-0.0009
	-0.30	0.19	-0.42	-0.52
US Sentiment ×	0.0001	-0.0025	0.0033	0.0003
Uncertainty	0.05	-1.23	1.24	0.69
Panel D: Local measures, two years ahead				
	GDP	Consumption	Investment	Unemployment
CCI	0.0013	-0.0004	0.0008	-0.0005
	0.28	-0.09	0.09	-0.31
Macro Uncertainty	0.0054	0.0058	-0.0168	0.0041**
	0.64	0.64	-1.32	2.00
CCI × Macro Uncertainty	-0.0021	-0.0017	-0.0138***	0.0026***
	-1.27	-0.90	-4.88	4.17

Table 5. GDP forecasts for the OECD

Panel regressions of macroeconomic forecasts for real GDP in OECD countries, excluding the US, on text-based measures of sentiment and uncertainty obtained from US newspapers, local consumer confidence, and the local index of total macroeconomic uncertainty from Ozturk and Sheng (2018). The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. We consider contemporaneous forecasts in columns (1) and (2), one-year ahead forecasts (quarters t+1 through t+5) in columns (3) and (4), and two-year ahead forecasts (quarters t+6 through t+9) in columns (5) and (6). The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

Panel A. US measures						
	(1)	(2)	(3)	(4)	(5)	(6)
	Contemporaneous		One year head		Two years ahead	
US Sentiment	-0.0073	-0.0099	0.0226	0.0255	-0.0352*	-0.0356*
	-0.65	-0.94	1.29	1.62	-1.82	-1.81
US Uncertainty	-0.0129	0.0078	0.0333**	0.0099	-0.0144	-0.0116
	-1.16	1.14	2.16	0.89	-1.42	-1.02
US Sentiment x		0.0137***		-0.0154***		0.0019
Uncertainty		3.91		-4.77		0.46
Observations	3418	3418	3414	3414	3352	3352
R-squared	0.2325	0.3233	0.2634	0.2976	0.1197	0.1202

Panel B. Local measures						
	(1)	(2)	(3)	(4)	(5)	(6)
	Contemporaneous		One year head		Two years ahead	
CCI	0.0554***	0.0497***	0.0216	0.0309**	0.0037	0.0089
	5.57	6.19	1.53	2.44	0.21	0.49
Macro Unc.	-0.0709***	-0.0636***	-0.0083	-0.0202	0.0449	0.0384
	-3.37	-3.41	-0.16	-0.41	1.18	0.95
CCI x		0.0119***		-0.0194***		-0.0107*
Macro Unc.		5.04		-3.38		-1.72
Observations	1637	1637	1633	1633	1629	1629
R-squared	0.6297	0.6533	0.3756	0.3975	0.1357	0.1428

Table 6. Real GDP growth and financial development

Panel regressions of GDP growth in OECD countries, excluding the US, on text-based measures of sentiment and uncertainty obtained from US newspapers and measures of country-level financial development (FD). The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. The independent variables are standardized to ease the interpretation of the results. Financial development is defined as the ratio of market capitalization, stock trading, domestic credit, and monetary credit to GDP, and GDP per capita. We estimate these measures as averages over the period 1975-1990 and estimate our regressions in the post-1990 subsample. In Panel A, we consider contemporaneous GDP growth. In Panel B, we consider future growth over the subsequent year (quarters t+1 through t+5). The sample period ends in Q4 2022.

Panel A: Contemporaneous regressions

	Market Cap	Stock Trading	Dom. Credit	Mon. Credit	GDP per capita
US Sentiment	-0.0059	-0.0069	-0.0071	-0.0077	-0.0077
	-1.08	-1.25	-1.27	-1.28	-1.25
US Uncertainty	-0.0003	-0.0008	-0.0005	-0.0006	-0.0011
	-0.26	-0.66	-0.41	-0.44	-0.86
US Sentiment ×	0.0041***	0.0042***	0.0042***	0.0043***	0.0043***
Uncertainty	3.95	4.07	4.15	4.16	4.18
US Sentiment × FD	0.0001	0.0002	0.0015	0.0008	0.0017**
	0.27	0.61	1.63	1.42	2.36
US Uncertainty × FD	-0.0001	0.0001	0.0005	-0.0003	0.0004
	-0.10	0.15	0.60	-0.52	0.50
US Sentiment ×	-0.0003***	-0.0004***	-0.0007***	-0.0007***	-0.0008***
Uncertainty × FD	-3.94	-2.99	-4.59	-4.88	-5.40
Observations	2260	2616	1302	1817	3343
R-squared	0.3799	0.3928	0.4074	0.3990	0.3796

Panel B: Predictive regressions

	Market Cap	Stock Trading	Dom. Credit	Mon. Credit	GDP per capita
US Sentiment	0.0083	0.0071	0.0069	0.0076	0.0078
	1.49	1.22	1.19	1.20	1.21
US Uncertainty	-0.0001	-0.0004	-0.0005	0.0001	0.0000
	-0.04	-0.10	-0.15	0.03	0.01
US Sentiment ×	-0.0036***	-0.0038***	-0.0037***	-0.0039***	-0.0037***
Uncertainty	-4.31	-4.19	-4.12	-4.04	-3.76
US Sentiment × FD	-0.0005	-0.0015*	0.0000	0.0002	0.0026**
	-0.68	-1.93	0.03	0.22	2.27
US Uncertainty × FD	0.0008	0.0002	0.0014	0.0007	0.0040***
	0.81	0.21	0.94	0.85	3.53
US Sentiment ×	0.0006***	0.0008***	0.0003*	0.0003**	0.0004
Uncertainty × FD	3.33	4.25	1.71	2.03	1.51
Observations	2265	2625	1302	1822	3353
R-squared	0.3203	0.3017	0.2740	0.2749	0.2768

Table 7. Real GDP growth forecasts and financial development

Panel regressions of GDP growth forecasts in OECD countries, excluding the US, on text-based measures of sentiment and uncertainty obtained from US newspapers and measures of country-level financial development (FD). The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. The independent variables are standardized to ease the interpretation of the results. Financial development is defined as the ratio of market capitalization, stock trading, domestic credit, and monetary credit to GDP, and GDP per capita. We estimate these measures as averages over the period 1975-1990 and estimate our regressions in the post-1990 subsample. In Panel A, we consider contemporaneous GDP growth. In Panel B, we consider future growth over the subsequent year (quarters t+1 through t+5). The sample period ends in Q4 2022.

Panel A: Contemporaneous regressions

	Market Cap	Stock Trading	Dom. Credit	Mon. Credit	GDP per capita
US Sentiment	-0.0236	-0.0273	-0.0226	-0.0267	-0.0266
	-1.11	-1.27	-1.33	-1.48	-1.15
US Uncertainty	0.0001	-0.0013	0.0005	-0.0011	-0.0012
	0.02	-0.27	0.10	-0.23	-0.22
US Sentiment ×	0.0129***	0.0135***	0.0126***	0.0132***	0.0142***
Uncertainty	3.10	3.26	3.70	3.75	3.47
US Sentiment × FD	-0.0004	-0.0004	0.0027	0.0036	0.0045
	-0.19	-0.26	0.79	1.44	1.06
US Uncertainty × FD	-0.0008	-0.0011	0.0011	0.0018	0.0028
	-0.19	-0.50	0.33	0.70	0.41
US Sentiment ×	-0.0006	-0.0009*	-0.0010**	-0.0010***	-0.0021***
Uncertainty × FD	-0.99	-1.92	-2.38	-2.96	-2.85
Observations	2121	2389	1007	1289	2822
R-squared	0.2732	0.2874	0.3057	0.2940	0.2539

Panel B: Predictive regressions

	Market Cap	Stock Trading	Dom. Credit	Mon. Credit	GDP per capita
US Sentiment	0.0413**	0.0365*	0.0207	0.0188	0.0381*
	2.24	1.88	1.17	0.99	1.87
US Uncertainty	0.0175	0.0168	0.0059	0.0070	0.0162
	1.55	1.42	0.51	0.56	1.20
US Sentiment ×	-0.0149***	-0.0157***	-0.0128***	-0.0141***	-0.0167***
Uncertainty	-5.06	-4.96	-4.21	-4.43	-4.64
US Sentiment × FD	-0.0095***	-0.0074**	0.0048	0.0050	0.0039
	-3.20	-2.46	0.90	1.09	0.81
US Uncertainty × FD	-0.0029	-0.0042	0.0052	0.0043	0.0089
	-0.72	-0.96	0.86	0.83	1.06
US Sentiment ×	0.0027***	0.0028***	0.0019**	0.0015**	0.0031*
Uncertainty × FD	3.95	3.47	2.56	2.04	1.71
Observations	2118	2387	1003	1285	2821
R-squared	0.3435	0.3372	0.3071	0.3027	0.2958

Table 8. Capital flows

Panel regressions of macroeconomic growth in OECD countries, excluding the US, on text-based measures of sentiment and uncertainty obtained from US newspapers and measures of capital flows between foreign countries and the US. These measures include foreign direct investments from the US (column 1) and to the US (column 2), and portfolio investments from the US either in equities (column 3) or all assets (column 4). We scale these measures by a country's GDP and express the ratio in logs. The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. The independent variables are standardized to ease the interpretation of the results. The sample period is from Q1 1985 to Q4 2022.

Dep. variable:	(1)	(2)	(3)	(4)
Real GDP growth	US-origin FDI / GDP	US-bound FDI / GDP	US-origin PI Equity / GDP	US-origin PI Total / GDP
US Sentiment	-0.0067	-0.0060	-0.0132	-0.0127
	-1.16	-1.18	-1.44	-1.40
US Uncertainty	-0.0010	-0.0002	-0.0041	-0.0038
	-0.81	-0.20	-1.37	-1.29
US Sentiment	0.0043***	0.0045***	0.0051***	0.0050***
× US Uncertainty	4.19	4.25	4.29	4.25
Flows	0.0071**	0.0026*	0.0059**	0.0011
	2.00	1.98	2.26	0.76
US Sentiment	-0.0026***	-0.0004	-0.0030***	-0.0028***
× Flows	-8.57	-0.82	-6.99	-4.34
US Uncertainty	-0.0011**	0.0004	-0.0012	-0.0007
× Flows	-2.48	0.43	-1.46	-0.63
US Sentiment	0.0004***	0.0001	0.0005***	0.0007***
× US Uncertainty × Flows	5.27	0.95	4.31	5.27
Observations	4033	3232	3028	3092
R-squared	0.3753	0.3723	0.4174	0.4176

Table 9. Baseline regressions in the US

Time-series regressions of macroeconomic growth in the US on text-based measures of sentiment, uncertainty, and sentiment volatility in the US obtained from US newspapers. The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include quarter and year fixed effects. The independent variables are standardized to ease the interpretation of the results. Sentiment volatility is defined as the standard deviation of sentiment calculated over a ten-year moving window (40 quarters). The sample period is from 1985 Q1 to 2021 Q4.

	Panel A			
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0064***	0.0078***	0.0034	-0.0048***
	4.98	4.94	0.94	-6.05
US Uncertainty	-0.0019	-0.0024	-0.0034	0.0021
	-1.21	-1.09	-1.31	1.55
Observations	146	146	146	146
R-squared	0.8734	0.8340	0.8182	0.8878
	Panel B			
	GDP	Consumption	Investment	Unemployment
US Sentiment	-0.0001	-0.0002	-0.0023	0.0009
	-0.08	-0.10	-0.49	0.82
US Uncertainty	-0.0004	-0.0006	-0.0021	0.0007
	-0.36	-0.33	-0.70	0.63
US Sentiment × Uncertainty	0.0034***	0.0041***	0.0030***	-0.0030***
	7.78	10.28	2.91	-10.32
Observations	146	146	146	146
R-squared	0.9336	0.9147	0.8382	0.9568

Table 10. Reversals in the US

Time-series regressions of future macroeconomic growth in the US on text-based measures of sentiment and uncertainty in the US obtained from US newspapers. Macroeconomic growth is calculated one year ahead in Panel A (quarters t+1 through t+4) and two years ahead in Panel B (quarters t+5 through t+8). The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include quarter and year fixed effects. The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

Panel A: One year ahead				
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0004	-0.0011	0.0014	-0.0009
	0.12	-0.32	0.14	-0.47
US Uncertainty	0.0026	0.0046	0.0048	-0.0042
	0.53	0.96	0.70	-1.46
US Sentiment ×	-0.0028***	-0.0036***	-0.0018	0.0018***
Uncertainty	-4.56	-5.79	-1.26	4.03
Observations	146	146	146	146
R-squared	0.8573	0.8816	0.9121	0.8419
Panel B: Two years ahead				
	GDP	Consumption	Investment	Unemployment
US Sentiment	-0.0013	-0.0008	-0.0011	0.0004
	-0.36	-0.23	-0.17	0.20
US Uncertainty	-0.0045	-0.0063	-0.0002	0.0049
	-0.56	-0.83	-0.02	0.99
US Sentiment ×	-0.0010	-0.0006	-0.0007	0.0018
Uncertainty	-0.82	-0.54	-0.43	1.31
Observations	142	142	142	142
R-squared	0.8020	0.7951	0.9224	0.7381

Table 11. GDP forecasts in the US

Time-series regressions of macroeconomic forecasts for real GDP in the US on text-based measures of sentiment and uncertainty in the US obtained from US newspapers. The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of the dependent variable, sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include quarter and year fixed effects. We consider contemporaneous forecasts in columns (1) and (2), one-year ahead forecasts (quarters t+1 through t+5) in columns (3) and (4), and two-year ahead forecasts (quarters t+6 through t+9) in columns (5) and (6). The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

	(1)	(2)	(3)	(4)	(5)	(6)
	Contemporaneous		One year head		Two years ahead	
Sentiment	0.0263***	0.0015	-0.0146	0.0082	-0.0016	0.0063
	4.49	0.21	-1.05	0.54	-0.10	0.63
Uncertainty	-0.0081	-0.0021	0.0182	0.0126	-0.0073	-0.0092
	-1.34	-0.55	0.92	0.61	-0.30	-0.35
Sentiment x		0.0130***		-0.0121***		-0.0041
Uncertainty		7.58		-5.54		-0.72
Observations	146	146	146	146	146	146
R-squared	0.8877	0.9386	0.8496	0.8633	0.7991	0.8007

Figure 1. Distribution of sentiment correlations between the US and the OECD

Distribution of pairwise correlation coefficients between our measure of US text-based sentiment and country-specific consumer confidence indices for the OECD countries, excluding the US, from 1985 Q1 to 2021 Q4.

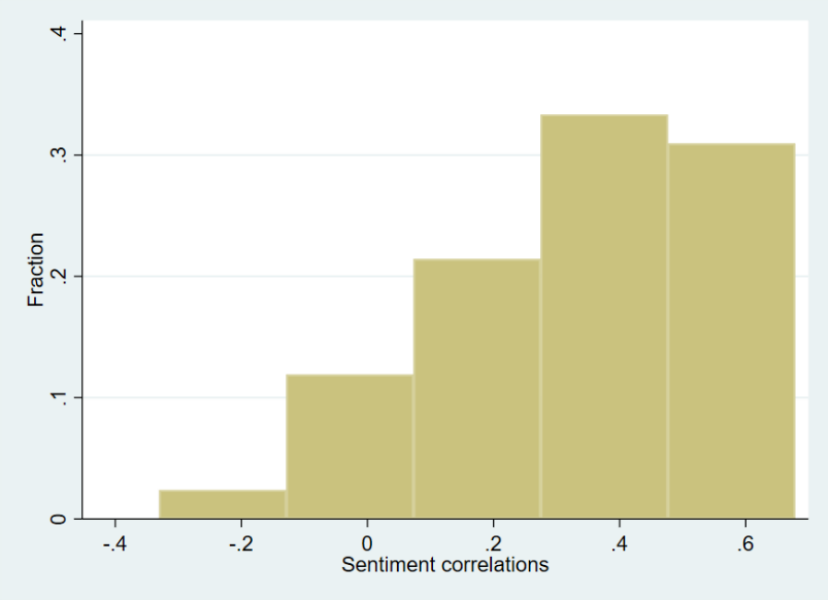


Figure 2. Distribution of uncertainty correlations between the US and the OECD

Distribution of pairwise correlation coefficients between our measure of US text-based uncertainty and country-specific total economic uncertainty indices from Ozturk and Sheng (2018) for the OECD countries, excluding the US, from 1985 Q1 to 2021 Q4.

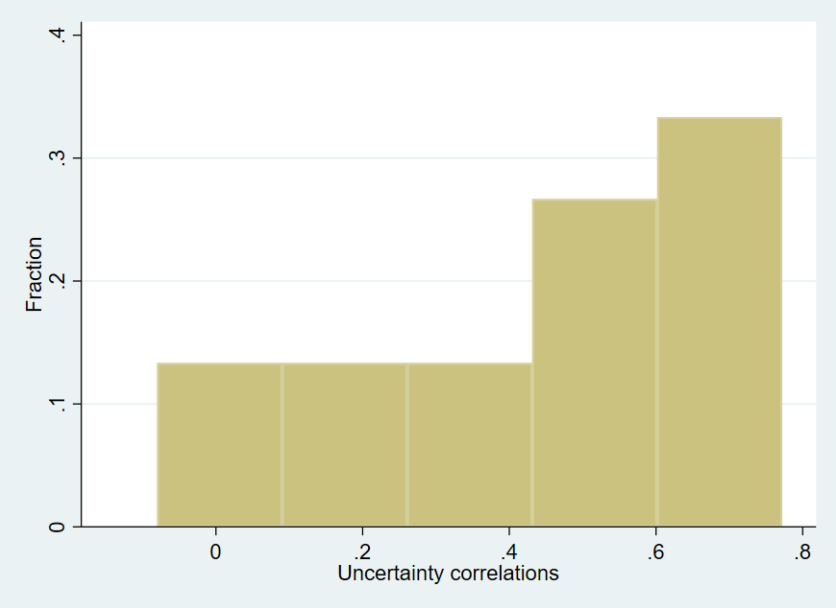
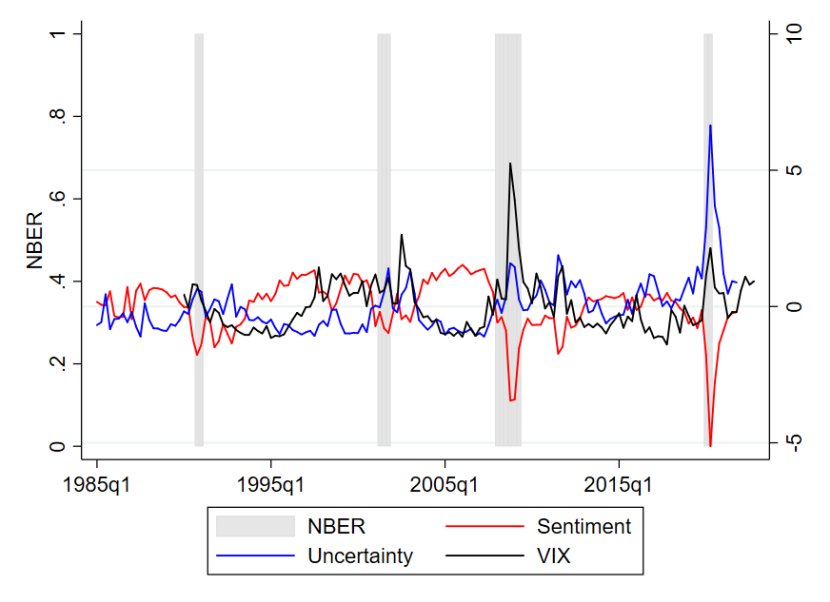


Figure 3. Time-series plot of US sentiment and uncertainty

Time-series plot of US text-based measures of sentiment and uncertainty, NBER recessions, and the VIX. The sample period is from 1985 Q1 to 2021 Q4.



Appendix

Rational expectations

$$\Sigma = \rho^2 \frac{1}{\Sigma^{-1} + \sigma_s^{-2}} + \sigma_\theta^2$$

$$\frac{\partial \Sigma}{\partial \sigma_\theta^2} = \rho^2 \frac{\Sigma^{-2}}{(\Sigma^{-1} + \sigma_s^{-2})^2} \frac{\partial \Sigma}{\partial \sigma_\theta^2} + 1$$

$$\left\{1 - \rho^2 \frac{\Sigma^{-2}}{(\Sigma^{-1} + \sigma_s^{-2})^2}\right\} \frac{\partial \Sigma}{\partial \sigma_\theta^2} = 1$$

$$\frac{\partial \Sigma}{\partial \sigma_\theta^2} > 1$$

$$\frac{\partial \Sigma}{\partial \sigma_s^2} = -\frac{\rho^2}{(\Sigma^{-1} + \sigma_s^{-2})^2}\left\{-\Sigma^{-2} \frac{\partial \Sigma}{\partial \sigma_s^2} - \sigma_s^{-3}\right\}$$

$$\left\{1 - \frac{\rho^2}{(\Sigma^{-1} + \sigma_s^{-2})^2} \Sigma^{-2}\right\} \frac{\partial \Sigma}{\partial \sigma_s^2} = \frac{\rho^2 \sigma_s^{-3}}{(\Sigma^{-1} + \sigma_s^{-2})^2}$$

$$\frac{\partial \Sigma}{\partial \sigma_s^2} > 1$$

Note that $\theta_t = \rho\theta_{t-1} + \varepsilon_{\theta,t}$ implies that $var(\theta_t) = \frac{\sigma_\theta^2}{1-\rho^2}$. Also, $s_t = \theta_t + \varepsilon_{s,t}$ implies that$var(s_t) = var(\theta_t) + \sigma_s^2$. Therefore,

$$\frac{\rho\sigma_s^{-2}}{\Sigma^{-1} + \sigma_s^{-2}} = \frac{\rho}{\sigma_s^2\Sigma^{-1} + 1}$$

$$= \frac{\rho}{\{var(s_t) - var(\theta_t)\}\Sigma^{-1} + 1}$$

$$= \frac{\rho}{\left\{var(s_t) - \frac{\sigma_\theta^2}{1-\rho^2}\right\}\Sigma^{-1} + 1}$$

Therefore, $\frac{\rho\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}}$ is decreasing in $var(s_t)$ and increasing in σ_θ^2.

Next we address the response of the inferred state of the economy to the contemporaneous and lagged signals.

$$\widehat{\theta_t} = \frac{\rho\Sigma^{-1}}{\Sigma^{-1} + \sigma_s^{-2}} \widehat{\theta}_{t-1} + \frac{\rho\sigma_s^{-2}}{\Sigma^{-1} + \sigma_s^{-2}} s_t$$

$$= \frac{\rho\Sigma^{-1}}{\Sigma^{-1}+\sigma_s^{-2}}\left[\frac{\rho\Sigma^{-1}}{\Sigma^{-1}+\sigma_s^{-2}}\hat{\theta}_{t-2} + \frac{\rho\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}}s_{t-1}\right] + \frac{\rho\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}}s_t$$

Therefore, $\partial\hat{\theta}_t/\partial s_t = \frac{\rho\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}}$. The contemporaneous effect of the signal on the inferred state of the economy is positive and is decreasing in $var(s_t)$ and increasing in σ_θ^2. Also, $\partial\hat{\theta}_t/\partial s_{t-1} = \frac{\rho\Sigma^{-1}}{\Sigma^{-1}+\sigma_s^{-2}}\frac{\rho\sigma_s^{-2}}{\Sigma^{-1}+\sigma_s^{-2}}$. The one-lag effect of the signal on the inferred state of the economy is positive.

Diagnostic Expectations

$$\theta_t^{diag} \equiv \frac{\rho\Sigma^{-1}-\eta}{\Sigma^{-1}+\sigma_s^{-2}}\theta_{t-1}^{rational} + \frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}}s_t$$

$$= \frac{\rho\Sigma^{-1}-\eta}{\Sigma^{-1}+\sigma_s^{-2}}\left[\frac{\rho\Sigma^{-1}-\eta}{\Sigma^{-1}+\sigma_s^{-2}}\theta_{t-1}^{rational} + \frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}}s_{t-1}\right] + \frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}}s_t$$

Therefore,

$$\partial\hat{\theta}_t/\partial s_t = \frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}} > 0$$

$$\partial\hat{\theta}_t/\partial s_{t-1} = \frac{\rho\Sigma^{-1}-\eta}{\Sigma^{-1}+\sigma_s^{-2}}\frac{\rho\sigma_s^{-2}+\eta}{\Sigma^{-1}+\sigma_s^{-2}} < (>)0, \quad \text{if } \eta > (<)\rho\Sigma^{-1}.$$

ONLINE APPENDIX

A1. Symmetry of the effect of sentiment

Diagnostic expectations could, in principle, be asymmetric: $\widehat{\theta_t} = \theta_t^{diag} = \frac{\rho\Sigma^{-1}-\eta^+}{\Sigma^{-1}+\sigma_s^{-2}}\theta_{t-1}^{rational} + \frac{\rho\sigma_s^{-2}+\eta^+}{\Sigma^{-1}+\sigma_s^{-2}}s_t,\ s_t > \theta_{t-1}^{diag}$ and $\widehat{\theta_t} = \theta_t^{diag} = \frac{\rho\Sigma^{-1}-\eta^-}{\Sigma^{-1}+\sigma_s^{-2}}\theta_{t-1}^{rational} + \frac{\rho\sigma_s^{-2}+\eta^-}{\Sigma^{-1}+\sigma_s^{-2}}s_t,\ s_t \leq \theta_{t-1}^{diag}$, where $\eta^+ \neq \eta^-$. In Table A1, we report the average sentiment beta across countries (column 1). We also estimate sentiment betas in high (above median) and low (below median) investment states, respectively (columns 2 and 3). The average betas from these subsamples are of similar magnitude and not statistically different from each other (column 4). The estimates are similar both in the extended sample (Panel A) and the restricted sample (Panel B). This result is important because it provides evidence that the effect of sentiment on macroeconomic expectations, particularly the degree of overreaction, is symmetric across different investment states (implying $\eta^+ = \eta^-$ in our model). Although the model prediction is in terms of positive and negative investment states, we consider subsamples in which investment is above or below its median value to ensure a sufficient number of observations.

Table A1. Cross-sectional regressions: Investment breakdown

Cross-sectional regressions of sentiment betas on macroeconomic and sentiment volatility in the OECD countries excluding the US. This table reports t-tests to analyze whether the mean sentiment beta is significantly different from zero for the countries in our sample (column 1), whether this results is concentrated in the subsample of quarters in which capital formation growth is above its median value (column 2) or below (column 3), and whether the difference between the latter two betas is significantly different from zero (column 4). To estimate sentiment betas, we separately run a time-series regression of country-level capital formation growth on text-based US sentiment innovations, controlling for the US fundamentals from Ludvigson and Ng (2009). In Panel A, we consider the entire sample. In Panel B, we consider the subsample of countries for which we observe the full set of macroeconomic variables. The sample period is from 1985 Q1 to 2021 Q4.

Panel A. Full sample

	(1) Beta	(2) Beta High	(3) Beta Low	(4) Beta differential
Mean	0.3319***	0.2184***	0.1761***	0.0424
	8.95	5.25	6.74	1.00
Observations	40	40	40	40

Panel B. Restricted sample

	(1) Beta	(2) Beta High	(3) Beta Low	(4) Beta differential
Mean	0.3223***	0.2200***	0.1699***	0.0501
	8.39	4.86	5.77	1.08
Observations	34	34	34	34

A2. Non-linearities in the cross-sectional regressions

One potential concern with our cross-sectional results is that the volatility of sentiment may capture non-linearities related to the average level of sentiment in our countries. To address this issue, we re-estimate both sets of cross-sectional regressions controlling for the mean and squared mean of sentiment. The estimates, reported in Table A2, are robust to this alternative specification. Our coefficients of interest are virtually unchanged in both magnitude and significance.

Table A2. Nonlinearities in the cross-sectional regressions

Cross-sectional regressions of sentiment betas on macroeconomic volatility and the mean, the squared mean, and the volatility of sentiment in the OECD countries excluding the US. To estimate sentiment betas, we separately run a time-series regression of country-level capital formation growth, either contemporaneous (Panel A) or one step ahead (Panel B) on text-based US sentiment innovations, controlling for the US fundamentals from Ludvigson and Ng (2009). Macroeconomic and sentiment volatility are respectively defined as the variance of country-level GDP growth and consumer confidence. All variables are expressed in logs and standardized to ease the interpretation of the results. In the first two columns, we consider the entire sample. In the last two columns, we consider the subsample of countries for which we observe the full set of macroeconomic variables. The sample period is from 1985 Q1 to 2021 Q4.

Panel A. Contemporaneous regressions				
	(1)	(2)	(3)	(4)
Macroeconomic volatility	0.6218***	0.6220***	0.8060***	0.8077***
	7.08	7.01	5.66	5.62
Sentiment mean	0.2448***	7.5140	0.1831***	13.2573
	3.48	0.19	2.95	0.47
Sentiment mean squared		-7.2692		-13.0747
		-0.18		-0.47
Sentiment volatility			-0.2612**	-0.2632**
			-2.10	-2.09
Observations	40	40	40	40
R-squared	0.4758	0.4760	0.5088	0.5093

Panel B. Predictive regressions				
	(1)	(2)	(3)	(4)
Macroeconomic volatility	-0.0424	-0.0430	-0.2616**	-0.2655**
	-0.55	-0.55	-2.41	-2.33
Sentiment mean	-0.1387**	-21.5319	-0.0653	-28.4110
	-2.55	-0.42	-1.31	-0.62
Sentiment mean squared		21.3932		28.3468
		0.42		0.61
Sentiment volatility			0.3109***	0.3152***
			3.75	3.51
Observations	40	40	40	40
R-squared	0.0221	0.0236	0.0688	0.0715

A3. Robustness of the panel regressions

We replace the US-based indices with indices derived from country-specific newspapers from Australia (Herald Sun, Courier Mail), Canada (The Globe and Mail, Toronto Star), Ireland (Irish Times, Irish Examiner), Israel (Jerusalem Post), New Zealand (New Zealand Herald, Dominion Post), and United Kingdom (Guardian, Daily Mail). The estimates are in Table A3. Despite the small country coverage outside the US, our local text-based measures of economic sentiment and uncertainty yield similar empirical results to those from the baseline regressions. A joint one-standard-deviation increase in local sentiment and uncertainty is associated with an increase in economic growth equal to 0.23% for local GDP, 0.25% for consumption, 0.60% for investment, and a decrease of 0.05% in unemployment.

Table A3. Robustness of the panel regressions

Panel regressions of macroeconomic growth in OECD countries, excluding the US, on text-based measures of sentiment and uncertainty obtained from local newspapers. The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

	Panel A			
	GDP	Consumption	Investment	Unemployment
Sentiment	0.0011	0.0003	0.0037	-0.0017***
	0.36	0.09	0.83	-3.96
Uncertainty	-0.0004	-0.0025 B	-0.0039	-0.0002
	-0.13	-0.81	-0.85	-0.74
Observations	546	546	546	546
R-squared	0.1292	0.1734	0.1505	0.3184
	Panel B			
	GDP	Consumption	Investment	Unemployment
Sentiment	-0.0009	-0.0026	-0.0015	-0.0013***
	-0.26	-0.62	-0.29	-3.14
Uncertainty	0.0003	-0.0015	-0.0021	-0.0003
	0.13	-0.51	-0.50	-1.20
Sentiment × Uncertainty	0.0023***	0.0035***	0.0060***	-0.0005**
	4.42	2.83	4.25	-1.98
Observations	546	546	546	546
R-squared	0.1402	0.1934	0.1688	0.3340

A4. The effect of sentiment volatility

Our model predicts that the magnitude of the sentiment effect should decrease with the volatility of sentiment signals. In this empirical setup, we identify the latter as the standard deviation of sentiment, estimated over a moving window of 40 quarters to ensure enough observations. The estimates, reported in Table A4, provide further support to our theoretical predictions. We find that a joint one-standard-deviation increase in sentiment and its volatility is associated with a decrease in the quarterly rate of growth of GDP and a subsequent reversal. As expected, the magnitude of the effect decreases with a country's degree of financial development.

Table A4. Real GDP growth and financial development: Sentiment volatility

Panel regressions of GDP growth in OECD countries, excluding the US, on text-based measures of sentiment, uncertainty, and sentiment volatility (SVol) obtained from US newspapers and measures of country-level financial development (FD). The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include country, quarter, and joint country-quarter fixed effects. The independent variables are standardized to ease the interpretation of the results. Sentiment volatility is defined as the standard deviation of sentiment calculated over a ten-year moving window (40 quarters). Financial development is defined as the ratio of market capitalization, stock trading, domestic credit, and monetary credit to GDP, and GDP per capita. We estimate these measures as averages over the period 1975-1990 and estimate our regressions in the post-1990 subsample. In Panel A, we consider contemporaneous GDP growth. In Panel B, we consider future growth over the subsequent year (quarters t+1 through t+5). The sample period ends in Q4 2021.

Dep. Variable:	(1)	(2)	(3)	(4)	(5)
GDP Growth	Market Cap	Stock Trading	Dom. Credit	Mon. Credit	GDP per capita
US Sentiment	0.0038	0.0108**	0.0066**	-0.0117*	0.0066
	0.53	2.43	2.14	-1.83	1.17
US Uncertainty	0.0084	0.0013	-0.0036	-0.0107*	0.0071
	0.96	0.32	-1.58	-1.72	1.30
US Sentiment ×	0.0115***	0.0063***	0.0038***	0.0065***	0.0081***
Uncertainty	8.08	7.23	6.45	6.67	6.88
US Sentiment × FD	0.0003	-0.0015	-0.0003	0.0043***	-0.0002
	0.50	-1.62	-0.60	2.89	-0.20
US Uncertainty × FD	-0.0012	-0.0015	-0.0004	0.0023	-0.0025*
	-1.44	-1.31	-0.60	1.53	-1.84
US Sentiment ×	-0.0009***	-0.0010***	-0.0004***	-0.0009***	-0.0013***
Uncertainty × FD	-7.22	-5.32	-3.75	-4.33	-5.66
US SVol	-0.0026	0.0020	0.0004	-0.0063**	0.0003
	-0.59	0.93	0.20	-2.34	0.12
US Sentiment × SVol	-0.0137***	-0.0064**	-0.0045***	-0.0104**	-0.0101***
	-3.06	-2.50	-3.23	-2.25	-3.14
US SVol × FD	0.0005	-0.0002	0.0010***	0.0021***	0.0006
	1.32	-0.46	3.54	3.28	1.11
US Sentiment × SVol	0.0012***	0.0013*	0.0012***	0.0022*	0.0021***
× FD	2.88	1.82	3.11	1.80	2.76
Observations	2440	1828	2054	878	1247
R-squared	0.5970	0.6641	0.6446	0.6317	0.6277

A5. Baseline time-series regressions: Alternative specifications

In Table A5 below, we show that the baseline results from our time-series regressions are not driven by our specific choice of lead-lag structure and controls.

Table A5. Baseline regressions for the US without controls

Time-series regressions of macroeconomic growth in the US on text-based measures of sentiment and uncertainty in the US obtained from US newspapers. The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

	Panel A			
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0037***	0.0021***	0.0112***	-0.0025***
	3.78	2.70	3.33	-2.64
US Uncertainty	-0.0009	-0.0018	0.0041	0.0010
	-0.69	-1.25	1.31	0.79
Observations	148	148	148	148
R-squared	0.1700	0.0999	0.2394	0.1477
	Panel B			
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0041***	0.0025**	0.0115***	-0.0031***
	3.25	2.22	2.88	-3.10
US Uncertainty	0.0034	0.0026	0.0072*	-0.0044*
	1.46	1.14	1.67	-1.81
US Sentiment × Uncertainty	0.0020***	0.0020***	0.0014**	-0.0025***
	4.62	3.69	2.50	-4.82
Observations	148	148	148	148
R-squared	0.3383	0.2533	0.2775	0.5337

A6. Baseline time-series regressions: Alternative macroeconomic outcomes

In Table A6 below, we show that the baseline results from our time-series regressions also hold for a few alternative definitions of macroeconomic outcomes.

Table A6. Baseline regressions in the US for other macroeconomic outcomes

Time-series regressions of macroeconomic growth in the US on text-based measures of sentiment and uncertainty in the US obtained from US newspapers. The dependent variables include the rate of growth of the industrial production index (IPI), and consumption of durable goods, nondurable goods, and services. The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of the dependent variable, sentiment, uncertainty, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include quarter and year fixed effects. The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

Panel A				
	IPI	Durables	Nondurables	Services
US Sentiment	0.0109***	0.0153**	0.0071***	0.0063***
	4.47	2.40	4.46	3.61
US Uncertainty	-0.0022	-0.0018	0.0009	-0.0036
	-0.78	-0.33	0.72	-1.34
Observations	146	146	146	146
R-squared	0.8982	0.7754	0.8224	0.7900

Panel B				
	IPI	Durables	Nondurables	Services
US Sentiment	0.0010	0.0067	0.0015	-0.0022
	0.52	1.43	1.04	-0.87
US Uncertainty	0.0001	0.0002	0.0021*	-0.0016
	0.05	0.04	1.94	-0.69
US Sentiment × Uncertainty	0.0051***	0.0044**	0.0029***	0.0044***
	7.34	2.50	7.60	9.20
Observations	146	146	146	146
R-squared	0.9483	0.7907	0.8656	0.8643

A7. Baseline time-series regressions: Sentiment volatility

We also test our model prediction on sentiment volatility in our time-series setup. The estimates, reported in Table A7 below, provide further support to our theoretical predictions. A joint one-standard-deviation increase in sentiment and its volatility, again estimated over a moving window of 40 quarters, is associated with a decrease in the quarterly rate of growth of GDP (0.35%), consumption (0.35%), and investment (0.90%), and an increase in unemployment (-0.28%).

Table A7. Sentiment volatility for the US

Time-series regressions of macroeconomic growth in the US on text-based measures of sentiment and uncertainty obtained from US newspapers and a measure of sentiment volatility (SVol), defined as the standard deviation of sentiment calculated over a five-year moving window. The controls include the eight principal components of US macroeconomic factors from Ludvigson and Ng (2009) and two lags of sentiment, uncertainty, sentiment volatility, the growth rates of GDP, consumption, and capital formation, changes in the unemployment rate and the inflation rate. All specifications also include quarter and year fixed effects. The independent variables are standardized to ease the interpretation of the results. The sample period is from 1985 Q1 to 2021 Q4.

	(1)	(2)	(3)	(4)
	GDP	Consumption	Investment	Unemployment
US Sentiment	0.0027	0.0012	0.0091	-0.0008
	0.88	0.36	1.23	-0.35
US Uncertainty	0.0015	0.0007	0.0060**	-0.0011
	1.01	0.38	2.02	-0.90
US Sentiment × Uncertainty	0.0046***	0.0051***	0.0067***	-0.0039***
	8.96	8.52	6.03	-17.87
US SVol	0.0071***	0.0115***	0.0120***	-0.0087***
	2.68	3.41	3.71	-6.28
US Sentiment × SVol	-0.0035**	-0.0035**	-0.0090***	0.0028***
	-2.18	-2.23	-2.79	2.58
Observations	104	104	104	104
R-squared	0.9604	0.9457	0.9107	0.9811

A8. Sentiment beta in the US sample

We also test the model predictions for sentiment beta in the US sample. To this end, we run a time series regression of US capital formation growth on US text-based sentiment innovations akin to the country-specific auxiliary regressions from the OECD analysis. We find that the coefficient of sentiment from this regression, reported in Table A8 below, is positive and highly significant (column 1). Furthermore, the coefficient is of similar magnitude in high and low investment states, respectively (columns 2 and 3), and the difference is not statistically significant (column 4). These additional results provide further evidence that the effect of sentiment on growth is symmetric across different investment states.

Table A8. US sentiment beta with investment breakdown

Time-series regression of US country-level capital formation growth on text-based US sentiment innovations, controlling for the US fundamentals from Ludvigson and Ng (2009). We consider the full sample in columns (1) and (4), and the subsamples of quarters with high (above median) and low (below median) investment growth in columns (2) and (3), respectively. In column (4), we include a dummy variable that takes on value one for high capital investment states and zero otherwise, and an interaction term with US sentiment innovations. The sample period is from 1985 Q1 to 2021 Q4.

	(1) Full	(2) High State	(3) Low State	(4) Full
US Sentiment	0.0074***	0.0058***	0.0053***	0.0074***
	3.33	6.43	2.81	4.03
US Sentiment × State Var.				-0.0026
				-1.04
State Variable				0.0176***
				9.90
Observations	147	71	76	147
R-squared	0.5444	0.6721	0.4032	0.7506