Incorporating the Beige Book into a Quantitative Index of Economic Activity*

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Abstract

We apply customized text analytics to the written description contained in the Beige Book to obtain a quantitative measure of current economic conditions. This quantitative Beige Book measure is then included into a dynamic factor index model that also contains other commonly used quantitative economic data. We find, that at the time the Beige Book is released, the Beige Book has information about current economic activity not contained in other quantitative data. This is particularly the case during recessionary periods. However, by three weeks after its release date,"old" Beige Books contain little additional information about economic activity not already contained in other quantitative data.

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1 Introduction

The Beige Book is a written description of economic conditions in each of the twelve district banks of the Federal Reserve System. It is released eight times a year, roughly two weeks before the FOMC meeting. Its release is typically greeted with interest in the financial press. Is this attention warranted?[1] Does the Beige Book contain information about current economic conditions? If so, can one use this information in a systematic manner? Can the information in the Beige Book be combined with other quantitative information to provide a clearer picture of current economic conditions? In order to answer these questions, one must convert the qualitative information in the Beige Book into quantitative information.

In this paper, we apply customized text analytics developed by Fulmer (2014) to extract quantitative information about current economic conditions from the Beige Book. These quantitative Beige Book indices are strongly correlated with current quarter real GDP. We then include a quantitative Beige Book measure into a revised version of the Aruoba, Diebold, and Scotti (2009) (ADS) index model of daily economic activity. The ADS index is based on a dynamic common factor model that extracts a daily economic activity factor from six economic indicators: weekly jobless claims, monthly industrial production, personal income less transfers, employment, and manufacturing trade growth, and quarterly real GDP growth. We find that when using the full-sample of final release data the inclusion of the Beige Book index into the ADS model has little effect on the estimated daily index of economic activity. We find this somewhat comforting. Our priors are that once the full-sample of quantitative information is available, written information in the Beige Book is unlikely to cause one to rewrite economic history. However, when conducting a "real-time" analysis of the last three recessions, we find that the Beige Book provides information about current economic activity not included in the other quantitative indicators present in the ADS index. Specifically, on the day that the Beige Book is released, including the Beige Book typically moves the ADS index towards its full-sample estimate ("the truth"). The informational contribution of the Beige Book is typically larger during recessionary periods than in normal times. By about three weeks after the Beige Book release date, however, the ADS indices with or without the Beige Book are very similar; the other information in the ADS index dominates whatever information the "old" Beige Book contains about current economic activity.

The paper is organized as follows. Section 2 contains a brief description of the Beige

[1] There is some skepticism about the usefulness of the Beige Book. Alan Blinder (1997) somewhat disparagely refers to the Fed's use of anecdotal information as "ask your uncle" means of gathering information.

Book and a brief review of the previous literature on quantifying the Beige Book. Section 3 describes the customized text analytics applied to the Beige Book. Section 4 describes how we incorporate the quantified Beige Book into the dynamic factor model underlying the ADS index. Section 5 compares the properties of the ADS index with and without the Beige Book. Section 6 concludes.

2 Background

The Beige Book is largely based on information that each of the twelve individual Federal Reserve District Banks gather from "contacts" in their district. These "contacts" are survey respondents, members of Bank Board of Directors, news reports, even officially released economic data. The information from these contacts is then summarized in the form of a written document. In addition to a written summary provided by each of the twelve districts, there is a national summary section in the Beige Book. This is written by one of the district Banks and is ostensibly based on the twelve district write-ups (the task of writing this summary is rotated among the twelve district banks). The information in the Beige Book is compiled during the period up to the "closing date" which is roughly ten days prior to the official release date. For example, the Beige Book that was released on September 3, 2014 had a closing date of August 22, 2014 and the Beige Book that was released on July 16, 2014 had a closing date of July 7, 2014. The Beige Book has been publicly released two weeks before the FOMC meeting since June 1983. Before that it was known as the "Red Book" and was not publicly available. When we conduct our empirical analysis, we use both the Beige and Red books.

2.1 Literature

Balke and Petersen (1998, 2002) were the first to attempt to quantify the information in the Beige Book. They "manually" read and scored each of the Beige Books from 1983 to 1997. Various features of the Beige Books were scored on a -2 to 2 scale by .5 increments.[2] The quantitative scores were then compared to actual real GDP growth. Figure 1 displays one of the Balke/Petersen Beige Book indices and real GDP growth over their sample. Clearly, from Figure 1, the Balke/Petersen index tracks real GDP growth pretty well. In general,

[2] They scored the National Summary, the four major sectors discussed in the National Summary, and the twelve District write-ups.

Balke and Petersen found that the Beige Book had predictive content for current quarter real GDP above and beyond other quantitative information available to analysts at the time the Beige Book is released. On the other hand, Balke and Petersen found that the predictive content of the Beige Book for next quarter real GDP growth was substantially lower than for current quarter real GDP growth. Follow up studies that have used human readers/scorers (see Fettig, et al (1999), Balke and Yucel (2000), Ginther and Zavodny (2001), Zavodny and Ginther (2005)) have also generally found that the Beige Book contains information about current economic conditions both at the national and district level but that Beige Book loses its informational advantage as other more recent data are released.

While the studies based on human readers of the Beige Book suggest that there is information in the Beige Book that could be useful for "nowcasting" current economic activity, little effort has been given to updating these original studies of the quantified Beige Book. There are several problems with employing human readers and scorers of the Beige Book. First, the time it takes to read and score the Beige Book makes it costly to update the Beige Book on a continual basis. Second, it is difficult to get a consistent reading of the Beige Book over longer time periods–readers may vary over time and even the same reader's interpretation can change over time. These two problems make it difficult to replicate and systematically update the human reader Beige Book indices.

Given the difficulties with "manually" reading and scoring the Beige Book, there have been a few attempts to apply simple textual analysis to the Beige Book. Payne (2001) developed a list of key word combinations and gave each a numerical score (-1 to 1 by .5 increments). He then counted the number of times these word combinations occurred in each district summary sentence. He found that the Beige Book had strong predictive content for current quarter real GDP growth and for the Coincident and Leading Economic Indicators. Armesto, et al. (2009) applied off-the-shelf text analytics software, *Diction*, to the Beige Book. Using the word dictionary in *Diction*, Armesto, et al. conducted a frequency count of words associated with "optimism increasing" and "optimism decreasing" to construct an optimism index ("optimism increasing") and a pessimism index ("optimism decreasing"). They used mixed frequency estimation (MIDAS) to account for the irregular spacing of the Beige Book and found the Beige Book had predictive content for aggregate and district economic activity. Sadique, et al. (2013) also used an off-the-shelf text analytics software, *GeneralInquirer*, to quantify the discussion of Beige Book. Using the dictionary in *GeneralInquirer*, they extract the "tone" of the Beige Book; that is, whether the discussion is positive/negative and increasing/decreasing. They found the "tone" of the Beige Book to be associated with phases of the business cycle as well as with changes with financial market

volatility and volume.

3 Text mining the Beige Book

While the above studies go beyond simple word counts and are useful first attempts at quantifying the Beige Book, our view is that they fall short of the full potential of applying text analytics to the Beige Book. The ultimate goal of text analytics is to have the computer read the Beige Book in a way similar to a sophisticated human reader. It would involve looking for word combinations or patterns that are of specific interest to the "reader". This involves using application-specific word dictionaries. It would take advantage of grammatical relationships between words to extract meaning from the text. Finally, it would read the Beige Book in "context"; that is, it would use information outside the Beige Book in order to interpret the discussion inside the Beige Book.

In this application, we employ a customized text analysis of the Beige Book. Our analysis builds on the work of Fulmer (2014). Fulmer develops a suite of algorithms to extract information from the Beige Book about the state of current economic activity. These algorithms have many of the features that a sophisticated human reader uses when reading the Beige Book: employing a word dictionary relevant for describing economic activity; searching for word combinations or patterns that are indicative of current economic activity; using grammatical structure to tease out economically meaningful relationships between words. The output of the text analysis will be five different Beige Book indices. Three of the indices search for words or word patterns that have predictive content for real GDP growth. A fourth uses the grammatical structure of the text combined with a specialized word dictionary. The fifth is an ensemble index that includes elements of all four basic text analytic indices.

3.1 Initial filtering of the Beige Book Documents

In this application, we use the discussion in the National Summary. This is typically 4-5 pages long and represents a summary of the discussion in all the twelve Federal Reserve Districts. When looking at the 393 Beige (and Red) Book documents produced from May, 1970 to September, 2014, there are over 13,000 unique character terms in the National Summary section. To extract meaningful information from the Beige Book documents, we first filter the Beige Books by stripping each report of its punctuation and then extracting specific parts-of-speech from each sentence. The parts-of-speech included in the Beige Book

documents are limited to nouns, verbs, adjectives and adverbs. Furthermore, the stems of the words are used rather than the raw character strings in order to reduce the dimensionality of the terms and to combine morphologically similar character strings into concept groupings. Thus, character strings like "Increasing", "increasing", "increased", "increases", "increase" are all collapsed to the term "increas". This filtering reduces the number of unique character terms to around 5,000. Finally, we apply a custom Beige Book dictionary. The Beige Book dictionary consists of a list of accepted terms to be kept in the document; the rest of the terms are to be removed. Each of the close to 5,000 unique nouns, verbs, adjectives and adverbs within the Beige Book documents was individually accepted or rejected based on whether the term referred to or indicated the presence (or lack) of economic activity. After application of the dictionary filter, the number of terms in the Beige Book documents is reduced to roughly 10% of its original size. The remaining terms represent the raw data that we will apply statistical methods to in order to extract information from the Beige Book. This raw data we call Term Document matrix, A, whose dimension is $n \times m$ where n is the number of terms and m is the number of documents (observations). The elements in the matrix are just counts of the number of times a particular term shows up in a particular document.

3.2 Five Beige Book Indices

Despite the substantial reduction in the number of terms across documents achieved by filtering, the number of unique terms is still too large to provide clear signals about current economic activity. Furthermore, we want to extract the terms that are most relevant for the current growth rate in economic activity. We consider four alternative approaches to extract this information from the filtered document data.

Singular value decomposition (SVD) Index One way to reduce the dimension of terms to be considered is to apply the singular value decomposition (SVD) to the term document matrix, A. The approach here is similar in spirit to principle component analysis. The singular value decomposition is given by $A = UDV'$, where $U_{(n\times n)}$ and $V_{(m\times m)}$ are orthonormal matrices and $D_{(n\times m)}$ is a matrix with values along the diagonal and zeros off the diagonal. We take the columns of V associated with the k largest values of the D matrix. The dimensional choice, k, for the singular value projection of the term-document matrix is a tuning parameter chosen by the researcher. Lower dimension singular value decompositions are better suited for out-of-sample prediction, while higher dimension decompositions will

yield better in-sample fits of the data. In this application, we chose a dimension of $k = 15$. Fulmer (2014) found that a SVD dimension between 10-20 balanced the trade-off between in-sample and out-of-sample performance reasonably well. These fifteen "components" were then used in a regression of real GDP growth; the coefficients of which were used as weights on the components in the SVD index.

Positive/Negative (PN) Index Here we construct an index similar to the "optimism" and "pessimism" indices created by *Diction* or the "positive/negative" indices created by *GeneralInquirer*. Every term in a Beige Book document was classified into one of three categories: positive, negative, and neutral. For example, "grow" would be classified as (+1) while "decreas" would be classified as (-1) and "unchang" would be classified as (0). The number of "positive" terms and the number of "negative" terms in a document were then summed to create indices of positivity and negativity for each document. These aggregate indices were then standardized by dividing by the total number of terms in the document. Having a positive and negative score for each Beige Book, these were then used as independent variables in a real GDP regression. The coefficients from that regression formed the weights in the PN index.

Key Word Index It is possible that the frequency of certain words might provide substantial information about economic activity.[3] Given the large body of words in the Beige Book document, however, it may not be possible to identify these key words in advance. Thus, the Key Word index searches for words whose frequency of usage appears to be related to real GDP growth. Given that there are close to 1300 raw terms even after the initial filtering, we first reduce these to the top 200 terms based on an entropy weighted frequency count.[4] This weighting assigns relatively greater weight to words that have high counts in a few documents and low counts in the remaining documents. Words whose frequency across the documents is relatively uniform provide little information about changes in economic activity and, hence, will receive low weight. Of these 200 terms, we then search for the set of terms that is most closely related to real GDP growth.[5] It turns out that the best subset consists of the frequency count of the following ten words: "increas", "strong", "declin",

[3] For example the *Economist*'s recession index is a count of the number of times "recession" appears in a select group of news publications.

[4] See Fulmer (2014).

[5] We use the subset regression algorithm in R to determine the best model (see Miller (2002) and Gatu (2006)). This algorithm searchs for the "best" model for a given number of terms (here from 5 to 20 terms). The optimal number of terms is determined by minimizing the Bayesian Information Criteria.

"cost", "weaken", "eas", "vacanc", "brisk", "strike", and "borrow".

Atomic Fact Extraction (AFE) Index Unlike the previous three indices that essentially look for patterns in word counts across the Beige Book documents, the Atomic Fact extraction uses grammatical relationships between words to extract information from the text. The simplest grammatical relationship would be the subject noun and the verb from each sentence. However, other grammatical relationships in a sentence might prove useful as well. Table 1 lists the set of eleven grammatical dependencies considered. Similar to the positive/negative index discussed above, every noun, verb, adverb and adjective in the Beige Book dictionary was assigned a positive, negative, or neutral value (+1, -1, and NA, respectively). Using these values, the atomic fact score of the sentence clause is created by multiplying the classifiers together. For example, a sentence with the relationship "output rises" would score (+1)(+1) = 1 while another sentence with "layoffs increas" would score (-1)x(+1) = -1. After obtaining the score for each individual sentence clause, the atomic fact index of the document is obtained by summing the scores of the individual sentence clauses and then dividing by the maximal score possible for the document. This standardization ensures that longer documents do not receive larger index values simply because they contain more sentence clauses than shorter documents.

Ensemble Index Here we combine the elements in the previous four indices. Specifically, we take the components identified in the text analysis–the SVD components, the positive and negative indices, the 10 "key" words, and the Atomic Fact Extraction Index–and put all of these in a single regression with real GDP growth as the dependent variable. The coefficients from the regression determine the weights that the various components receive in the Ensemble Index.

3.3 Quantitative properties of the Beige Book Documents

Figure 2 displays the five Beige Book indices. To make them comparable, we standardize each index by subtracting their sample means and dividing by their sample standard deviations. Figure 2 also plots the simple average of the five Beige Book series (similarly standardized). From the figure, it is clear that these indices move together and share many of the same cyclical qualities. The contemporaneous correlations among the five series range from a low of 0.34 (between the Positive/negative (PN) index and the Key Word index) to a high of 0.87 (between the Atomic Fact Extraction (AFE) and the PN index). To see how

the text analytics Beige Book score compares with scores based on human readers, Figure 3 displays the average of the five Beige Book indices with the standardized Balke-Petersen National Summary index. Both indices share the same cyclical pattern and have a correlation coefficient of 0.57. This suggests that computer reading of the Beige Book and the human reading of the Beige Book yield similar interpretations.

To get a sense of how well the Beige Book indices capture changes in aggregate economic activity, Table 2 contains the results of regressing real GDP growth against the underlying components making up the Beige Book indices. For all five indices, the Beige Book components are jointly statistically significant. Not surprisingly, given the substantially larger number of parameters the SVD, the Key Word, and Ensemble indices have better in-sample fits than the AFE and PN indices. Including lags of real GDP growth in the regression does not eliminate the joint significance of the Beige Book components in the real GDP regression (see Table 3).

4 Daily index of economic activity containing the Beige Book

While the quantitative Beige Book indices appear to reflect current economic activity, most analysts are not likely to use the Beige Book in isolation. Here we add the average of our five Beige Book indices to the revised version of the Aruoba, Diebold, and Scotti (2009) index of daily economic activity. The most recent version of this model is maintained by the Federal Reserve Bank of Philadelphia. One challenge in combining the Beige Book with other economic indicators is the irregular frequency of the Beige Book's release. The ADS model is particularly attractive for our application as it can readily accommodate data of different frequencies and, in particular, the irregular frequency of the Beige Book.

4.1 ADS common factor model

The ADS model is a common factor model in which the underlying state variable reflects daily economic activity and the common co-movement of the observables is the result of time aggregation of this underlying daily state variable. Indicators include observations of weekly initial claims for unemployment insurance (JC), quarterly real GDP (GDP), monthly industrial production growth (IP), growth in real personal income less transfer receipts (I), monthly real manufacturing and trade sales (MT), and monthly employees and non-

agricultural payrolls (EM). To these six indicators, we add our Beige Book (BB) index. Following the Philadelphia Fed version of the ADS index, we log difference all the variables except initial jobless claims and the Beige Book index. Accordingly, the vector of observables is expressed as:

$$y_t = \Big(\; JC_t, \;\; \Delta GDP_t, \;\; BB_t, \;\; \Delta IP_t, \;\; \Delta I_t, \;\; \Delta MT_t, \;\; \Delta EM_t \; \Big)' \tag{1}$$

In our estimation, we will standardize all the observable indicators by subtracting off their sample means and dividing by their sample standard deviations.

Let x_t denote underlying economic activity on day t. x_t is assumed to follow an $AR(p)$ process,

$$x_t = \rho_1 x_{t-1} + \rho_2 x_{t-2} + ... + \rho_p x_{t-p} + e_t \tag{2}$$

where e_t is a white noise innovation with variance so that x_t has an unit unconditional variance. If all the data were observed daily, the indicator i, y_t^i, depends on x_t and lags of y_t^i:

$$y_t^i = c_i + \beta_i x_t + \gamma_{i1} y_{t-1}^i + ... + \gamma_{in} y_{t-n}^i + u_t^i \tag{3}$$

where u_t^i are contemporaneously and serially uncorrelated innovations. The parameter β_i is the factor loading of daily economic activity on the observable variable.

In practice, the indicators are not observed at a daily frequency. As the indicators are flow variables and are observed at a lower frequency than daily, one must temporally aggregate the effect of the daily economic variable on the observables. As a result, the observations of indicator i, $\widetilde{y}_t^i$, are intra-period sums of the corresponding daily values:

$$\widetilde{y}_t^i = \begin{cases} \sum_{j=0}^{D_i - 1} y_{t-j}^i & \text{if } \widetilde{y}_t^i \text{ is observed} \\ NA & \text{otherwise} \end{cases} \tag{4}$$

and D_i denotes the number of days since the last observation period. For all but most the recent time periods, we assume $\widetilde{y}_t^i$ is observed on the last day of the relevant period. For recent periods in which official data for the relevant time period have yet to be released, we treat $\widetilde{y}_t^i$ as missing (or NA).

Instead of combining equation (2) and (3) directly, cumulator variables, as proposed by Harvey (1989), are used to handle the temporal aggregation of the flow variables. By

cumulating values of the underlying business condition x_t, the cumulator variables summarize all the information needed to construct aggregated flow variables. We define the cumulators C_t^f, $f \in \left\{ \begin{array}{cccc} W, & M, & Q, & BB \end{array} \right\}$ as:

$$\begin{aligned} C_t^f &= \zeta_t^f C_{t-1}^f + x_t & (5) \\ &= \zeta_t^f C_{t-1}^f + \rho_1 x_{t-1} + ... + \rho_p x_{t-p} + \epsilon_t & (6) \end{aligned}$$

where C_t^W, C_t^M, C_t^Q, C_t^{BB} denotes the weekly cumulator, monthly cumulator, quarterly cumulator, and the cumulator for BB index respectively. Additionally, ζ_t^f is an indicator variable defined as:

$$\zeta_t^f = \begin{cases} 0 & \text{if } t \text{ is the first day of a period} \\ 1 & \text{otherwise} \end{cases} \tag{7}$$

For weekly, monthly, and quarterly variables, the first day of the period corresponds to the first day of the week, month, and quarter, respectively. For the the Beige Book variable, we take the first day of the period to be the day after the closing date of the previous Beige Book. Hence, the Beige Book will reflect the accumulated daily economic activity from the day after the closing date of the previous Beige Book to the closing date of the current Beige Book.

Based on the definition of the cumulators, the measurement equation for a generic flow variable can be $\widetilde{y}_t^i$ can be written as :

$$\widetilde{y}_t^i = \begin{cases} c_i^* + \beta_i C_t^i + \gamma_{i1} \widetilde{y}_{t-D_i}^i + ... + \gamma_{in} \widetilde{y}_{t-nD_i}^i + u_t^{*i} & \text{if } \widetilde{y}_t^i \text{ is observed} \\ NA & \text{otherwise} \end{cases} \tag{8}$$

where u_t^{*i} is an idiosyncratic shock to indicator i. The above model can be put into state space form (see Appendix for details) and estimated by maximum likelihood. For a given parameter vector, the likelihood can be evaluated using a Kalman filter and an estimate of the unobserved daily index can be obtained using the Kalman smoother. Note that factor loading for the daily economic activity state variable in the Beige Book observation equation (β_{BB}) is positive and statistically significant implying that observations on the Beige Book variable can shed some light on the (directly) unobserved daily factor (see Table A1 in the appendix).

5 Performance of Beige Book ADS Index

5.1 Full-sample ADS indices

Figure 4 presents the full-sample (from May 1970 to September 2014) estimates of the ADS index for the model with and without the Beige Book.[6] For reference real GDP growth is also displayed. As one can see, over the full-sample both ADS indices track real GDP growth very well. Furthermore, the difference between the full-sample ADS index with and without the Beige Book is relatively small; both indices are telling the same story about the underlying daily economic activity. To get closer look at the relative behavior of the ADS indices, Figure 5 just displays the period since 2007. Again, both the ADS with the Beige Book and without the Beige Book track real GDP growth relatively well. There are some small differences in the two indices perhaps worth noting. In early 2008, the ADS with the Beige Book suggests a slightly larger decline in economic activity than the ADS without the Beige Book, suggesting that economic activity was slightly weaker than implied by the other quantitative indicators. In September 2008, due to sharp one-time declines in Industrial Production and Manufacturing and Trade data, the ADS indices display a sharp drop in September and then a sharp but temporary "rebound" in October 2008. However, for the ADS Index with the Beige Book this "bounce back" is slightly less pronounced and presages the continued deterioration in the ADS indices later in 2008 and early 2009. These small differences notwithstanding, both indices are telling very similar stories about the underlying daily economic activity factor.

Figures 4 and 5 suggest that when one has full-sample information about all the other indicators, the Beige Book does not provide much additional information about current economic activity. We find this result unsurprising. We would not really expect the Beige Book to dramatically change our view of economic activity over time once the final releases of real GDP, industrial production, employment growth and the other indicators were available. That the full-sample ADS indices with and without the Beige Book are similar suggests that we are not "reading too much into Beige Book".

[6] These are based on the Kalman smoothed estimate of the state variables using the full-sample to estimate the parameters in the model as well as in the Kalman smoother.

5.2 Real-time examination of the ADS indices

While the Beige Book might not cause analysts to revise their view of economic history once all the data are available, where the Beige Book might be useful is when only incomplete or noisy information is available. The standard quantitative data are typically available with a lag and are often subsequently revised. For example, preliminary estimates of real GDP are released roughly one month after the quarter has ended. Furthermore, the real GDP data are going to be revised twice over the subsequent two months before the "third" estimate is released–nearly three months after the quarter has ended.[7] The Beige Book with its relatively quick release date (roughly ten days after the closing period) and text that is not subsequently revised may provide timelier and less noisy information about current economic conditions than some of the other economic indicators.

To investigate whether the Beige Book is useful when there is only partial information, we conduct a "real-time" examination of the ADS index with and without the Beige Book.[8] In particular, we examine the last three recessions to determine whether including the Beige Book can provide timely information about economic activity during these periods. To do this, we only use information that would have been available to analysts at the time both to estimate the ADS index models and then to update the estimate of economic activity. Specifically, we use data that were available up to a specified date before the recession to estimate the ADS model with and without the Beige Book; this also includes estimating the Beige Book indices using data that were available to analysts at the time.[9] Then during the recession period, we update the inference about the underlying state variable using only data as it becomes available in "real-time".[10]

Figure 6 displays the various paths of estimated ADS index without the Beige Book based on information available on the dates that the Beige Book was released. The black line in the figure is the estimated index based on the entire sample which we take as the "true" level of economic activity (recall the full-sample indices are very similar for indices with and without the Beige Book). Figure 7 displays the real and full-sample estimates with the Beige

[7] Furthermore, periodically, the historical GDP data are revised, meaning that the 'final' estimate of GDP might be released years after the fact.

[8] For manufacturing and the personal income series, we use the real time data set compiled by Giusto and Piger (2014) which, in turn, was based on Chauvet and Piger (2008). The industrial production, real GDP, weekly claims for unemployment insurance and monthly employees and non-agricultural payrolls are from the Philadelphia Fed real time website as well as from FRED (St. Louis Fed).

[9] The estimation periods are: for the 2007-2009 recession data up through 9/30/2007; for the 2001 recession.data up through 11/30/2000; for the 1990-1991 recession data up through 2/28/1990.

[10] We do not re-estimate the entire factor model, but use the updated data and the Kalman filter/smoother to estimate the underlying daily economic activity factor.

Book included in the ADS index. If one compares the two sets of indices, one finds that incorporating the Beige Book tends to move the estimated ADS index towards its full-sample estimate (if reading this paper electronically, one can see this better by "toggling" the screen displays of the figures back and forth and observe how the lines of the ADS with the Beige Book shift towards the full-sample estimate). For example, take the ADS indices based on information available on Beige Book release dates: 3/5/2008, 4/6/2008, 6/11/2008, and 9/3/2008. Including the Beige Book information moves the estimated daily index towards to the "truth" by between 20 to 50 basis points. Note that these were periods well before the depth of the actual economic decline was evident and the Beige Book is suggesting that economic activity was not as strong as suggested by the other available quantitative data. Similarly, including the Beige Book information released on 12/3/2008 moves the index by nearly 50 basis points down towards the eventual full-sample estimate.

Figures 8 and 9 and Figures 10 and 11 do a similar exercise for the 2001-2002 and 1990-1991 recessions, respectively. In many of the periods early in these recessions, at the time the Beige Book is released, using the Beige Book information yields estimates of the ADS index closer to the eventual full-sample estimate. For example, during the 2001 recession the Beige Books released on 1/17/2001, 3/7/2001, 5/2/2001 move the ADS index towards its full-sample estimate (compare Figures 8 and 9). In the 1990-1991 recession, the Beige Books released on 6/20/1990, 9/19/1990, 10/31/1990, 12/5/1990 move the ADS index towards its full-sample estimate (compare Figures 10 and 11). Note that a Beige Book release does not always lead to more accurate revision of the underlying state of economic activity. For example, the Beige Book released on 8/8/1990 has virtually no effect on the estimated index and the Beige Book released on 5/2/1990 actually moves the index further away from the "truth". Nonetheless, at the time that the Beige Books are released, many of Beige Books early in these recessions improve the estimate of current economic activity.

To obtain a quantitative assessment of the effect of including the Beige Book information in the Index of Economic Activity we calculate the real-time mean squared predictive error (MSPE) where the "target" is the full-sample estimate of the ADS index.[11] In terms of state space model described above, this amounts to calculating the difference between the Kalman smoothed value of the index based on the model estimated over the full-sample and the Kalman filtered estimate of the model estimated with information just prior to the recession. Table 4 displays the MSPE for the model with and without the Beige Book

[11] Here we compare the real time ADS index that does not contain the Beige Book information to the full-sample ADS index without the Beige Book information. Similarly, we compare the ADS that includes the Beige Book information to the full-sample ADS index that includes the Beige Book.

for the dates on which the Beige Books were released. Because the full-sample estimates differ slightly for the two models, we also include the mean squared difference between the full-sample estimates with and without Beige Book. For the 1990-1991 and the 2007-2009 periods, on the dates that the Beige Books were released, including the Beige Book information generally reduces the squared prediction errors by 15%. Only for the 2001-2002 period did including the Beige Book not lower the MSPE relative to not including the Beige Book. Note also that the difference between the full-sample estimates of the index with and without the Beige Book information over these recession periods is pretty small relative to the difference between the real-time and full-sample estimates. These results suggest that, at least for the 1990-1991 and 2007-2009 recessions, at the time the Beige Book is released, it could have provided additional information about current economic activity not contained in the other currently available data used in the ADS index.

How long does the Beige Book's informational advantage last? As other quantitative data are released, the information contained in the Beige Book about economic activity might be overshadowed by more recently released data. We can get a sense for how long the Beige Book advantage persists by examining how the inclusion of the Beige Book information affects the "nowcasting" performance on the days after the Beige Book release. As number of days since the Beige Book release increases, the more likely new quantitative data has arrived. By the day before the next Beige Book is to be released (roughly 41 days since initial Beige Book release), the Beige Book information is roughly six weeks old and there have been at least five new releases of jobless claims, one new release of industrial production, employment, personal income less transfers, and manufacturing/trade data, and a revision of the previous quarter GDP estimate, if not a release in the preliminary estimate of GDP.

Figure 12 displays, for the period October 1, 2007 to December 31, 2013, the ratio of the two model's MSPEs (for predictions of the full-sample ADS index) from zero to 41 days after the Beige Book release. A ratio less than one implies the Beige Book model has an informational advantage over the model without the Beige Book. According to Figure 12, the informational advantage of incorporating the Beige Book during this time period lasts about 15 days; after that time period the Beige Book model is not substantially better (and sometimes worse) than the non-Beige Book model at "nowcasting" the final value of the ADS index. Thus, on average, by the time that the Beige Book is two weeks old, it provides very little additional information about the ADS index of economic activity not already included in the other quantitative indicators. Figure 12 also plots the MSPE ratios for the subsample containing the recession period (October 1, 2007 to December 31, 2009). During the recession period the Beige Book's informational advantage seems to be larger and longer

lasting, suggesting that Beige Book might be more useful in recessionary or turning point periods than in more stable/tranquil periods.

5.3 Real-time forecasting of current quarter real GDP growth

In the previous section, we conducted a real time analysis of the contribution of the Beige Book to predicting the full-sample (final) estimate of the underlying daily index of economic activity. In this section, we examine the contribution of including the Beige Book as an observation variable in the ADS model (along with the other quantitative variables) towards predicting the current quarter real GDP growth (final estimates).

As our focus is on the usefulness of the Beige Book information in a quantitative index of economic activity and not on forecasting real GDP growth per se, we do not consider the large number of other forecasting models of real GDP growth. Instead, we use the ADS index model to forecast current quarter real GDP growth given the available information at a particular time. Specifically, we can use the observation equation for real GDP in the ADS model to forecast current quarter real GDP, or:

$$\widetilde{y}_{t_Q}^{GDP} = c_{GDP}^{*} + \beta_{GDP} C_{t_Q|t}^{Q} + \gamma_{GDP,1} \widetilde{y}_{t_Q - D_{GDP,1}}^{GDP} \tag{9}$$

where t is the time period in which forecast is being made and t_Q is the last day of the current quarter.[12] We consider time periods in the current quarter so that $t < t_Q$. From equation (9), this largely amounts to forecasting the value of the quarterly cumulator of the underlying daily state variable at the end of the quarter, $C_{t_Q|t}^{Q}$.[13]

We calculate the ratio of the MSPEs for forecasts of the final estimates of current quarter real GDP implied by the ADS index with and without the Beige Book. Here we examine the period October 1, 2007 until December 31, 2013. We also break up the MSPEs for forecasts when the date of the forecast is in the first month of the quarter and when date is in the third month of quarter. The idea is that forecasts of current quarter real GDP growth are likely to be worse when in the first month of the quarter than when in the third month of the quarter. In particular, Beige Books released in the first month of the quarter will contain information largely about previous quarter real GDP while Beige Books released in the third month of the quarter will contain information about the current quarter only.

[12] We actually "re-standardize" real GDP growth by multiplying the model's prediction for standarized real GDP growth by the sample standard deviation of real GDP growth and then add back in the sample mean.

[13] In periods where data for $\widetilde{y}_{t_Q - D_{GDP,1}}^{GDP}$ is not available, we use the forecasted value for this variable implied by the model.

From Figure 13, we observe that, aggregating over all Beige Book release dates, the ADS model with the Beige Book improves forecasts of current quarter real GDP growth relative to the model without the Beige Book by around seven percentage points at the time that the Beige Book is released. This informational advantage persists, although the magnitude of this advantage is relatively small.[14] Not surprisingly for Beige Books released in the first month of the quarter, the informational advantage is relatively small (and even negative). However, Beige Books released in the third month of the quarter improve MSPEs for current quarter GDP growth by over 12%. Again, Beige Books released in the third quarter are almost exclusively about economic activity in that quarter rather than the previous quarter. Figure 14 shows that during the recession period, October 1, 2007 through December 31, 2009, the Beige Book information released in the third month in the quarter improves MSPE of real GDP growth forecasts growth by over 15% and nearly 10% up two weeks after the Beige Book release date. This suggests that the Beige Book contains potentially useful information about real GDP growth above and beyond that contained in the other ADS indicators, but the informational advantage is more substantial later in the quarter than earlier in the quarter.

6 Conclusion

In this paper, we used text analytics to develop a quantitative index of the Beige Book. This index was in turn included as an observable variable in a dynamic factor model of economic activity based on Aruoba, Diebold, and Scotti (2009). We find that when all updated information about the observables is available the ADS index with and without the Beige Book are very similar, suggesting that including the Beige Book does not alter our historical view of economic activity. On the other hand, we find that at the time that the Beige Book is released using the information in the Beige Book can yield modest improvements in the estimated ADS index–moving it towards the full-sample estimates (the "truth"). This is more likely to be that case around turning points, than in more normal times. Unfortunately, the additional information in the Beige Book gets stale fast; by the time the Beige Book is three weeks old it provides very little additional information not already included in other more recently released quantitative indicators.

Overall, our results suggest that using the Beige Book information yields modest improve-

[14] We examined time period up to eighteen days after the Beige Book release. Beyond eighteen days there were too few observations in the third month of the quarter.

ments in "real time" in our inference about underlying economic activity. The development of computer based algorithms to "read" the Beige Book have substantially lowered the costs of including information contained in the Beige Book into quantitative index models of economic activity, so that these models can be continually updated and evaluated. It also opens the possibility that we can systematically learn from the Beige Book.

There are some directions for future research. Even though we used sophisticated text analytics, our computer essentially read the Beige Book "out-of-context". That is, aside from using real GDP growth to weight the different Beige Book components, when conducting the text analytics we only used the information in the Beige Book and ignored other information "outside" the Beige Book. It is conceivable that employing other quantitative information might allow one to better extract the word patterns/combinations that are of the greatest interest to an analyst, just like a human reader uses context to extract meaning from the text.

References

[1] Armesto, Michelle, Ruben Hernandez-Murillo, Micheal T. Owyang, Michael T. and Jeremy M. Piger (2009). "Measuring the information content of the Beige Book - A Mixed data sampling approach." *Journal of Money, Credit, and Banking*, 41(1), 35-55.

[2] Aruoba, S. Boragan, Francis X. Diebold, Chiari Scotti (2009). "Real-time measurement of business conditions," *Journal of Business and Economic Statistics* 27 (4), 417-27.

[3] Balke, Nathan S. and D'Ann Petersen (1998). "How well Does the Beige Book reflect economic activity? Evaluation qualitative information quantitatively. Federal Reserve Bank of Dallas Working Paper, 98-02.

[4] Balke, Nathan S., and D'Ann Petersen (2002). "How well does the Beige Book reflect economic activity? Evaluating qualitative information quantitatively." *Journal of Money, Credit, and Banking*, 34, 114–36.

[5] Balke, Nathan S. and Mine Yucel (2000). "Evaluating the Eleventh District's Beige Book." *Federal Reserve Bank of Dallas. Economic and Financial Review*, 2–10.

[6] Blinder, Alan (1997). "Distinguished lecture on economics in government: What central bankers could learn from academics–and vice versa." *Journal of Economic Perspectives*, 11 (Spring), 3-19.

[7] Chauvet, Marcelle and Jeremy Piger (2008). "A comparison of the real-time performance of business cycle dating methods," *Journal of Business and Economic Statistics*, 26, 42-49.

[8] Fettig, David, Arthur J. Rolnick, and David E. Runkle (1999). "The Federal Reserve's Beige Book: A better mirror than crystal ball." *Federal Reserve Bank of Minneapolis. The Region*, 28–32.

[9] Fulmer, Michael (2014). A Text Analytics analysis of the Federal Reserve Beige Book Corpus, Southern Methodist University Doctoral Dissertation.

[10] Gatu C (2006). "Branch-and-Bound Algorithms for Computing the Best-Subset Regression Models." *Journal of Computational and Graphical Statistics*, 15, 139–156.

[11] Ginther, Donna K., and Madeline Zavodny (2001). "The Sixth District Beige Book: Timely information on the regional economy." *Federal Reserve Bank of Atlanta. Economic Review*, 86, 19–29.

[12] Giusto, Andre and Jeremy Piger (2014). "Indentifying the business cycle turning points in real time with vector quantization," working paper.

[13] Harvey, A.C. (1989), Forecasting, Structural Time Series Models and the Kalman Filter. Cambridge: Cambridge University Press.

[14] Miller, Alan (2002). Subset Selection in Regression, 2nd Edition. Chapman & Hall.

[15] Payne, David R. (2001). "Anticipating monetary policy with the Federal Reserve's Beige Book: Re-specifying the Taylor rule." *Business Economics*, 36, 21–30.

[16] Zavodny, Madeline and Donna K. Ginther (2005). "Does the Beige Book move financial markets?" *Southern Economic Journal*, 78 (1), 138–151.

Appendix

The dynamic factor model in the text can be written in state space form:

$$\widetilde{y}_t = HS_t + AX_t + u_t^* \tag{A1}$$

$$S_t = F_t S_{t-1} + Z\epsilon_t \tag{A2}$$

where equation (A1) is the observation equation and (A2) is the state equation. The vector of observables is given by:

$$\widetilde{y}_t = \left(\widetilde{JC}_t, \ \widetilde{\Delta GDP}_t, \ \widetilde{BB}_t, \ \widetilde{\Delta IP}_t, \ \widetilde{\Delta I}_t, \ \widetilde{\Delta MT}_t, \ \widetilde{\Delta EM}_t \right)' \tag{A3}$$

and the state variables are:

$$S_t = \left(x_t, \ x_{t-1}, \ \ldots \ x_{t-p+1}, \ C_t^W, \ C_t^Q, \ C_t^M, \ C_t^{BB} \right)'. \tag{A4}$$

The vector of exogenous and predetermined variables in the observation equation is given by:

$$\begin{aligned} X_t =& (1, \widetilde{JC}_{t-W}, \widetilde{\Delta GDP}_{t-Q}, \widetilde{BB}_{t-BB}, \widetilde{\Delta IP}_{t-M}, \widetilde{\Delta I}_{t-M}, \widetilde{\Delta MT}_{t-M}, \\ & \widetilde{\Delta EM}_{t-M} \ldots\ldots \widetilde{JC}_{t-nW}, \widetilde{\Delta GDP}_{t-nQ}, \widetilde{BB}_{t-nBB}, \widetilde{\Delta IP}_{t-nM}, \\ & \widetilde{\Delta I}_{t-nM}, \widetilde{\Delta MT}_{t-nM}, \widetilde{\Delta EM}_{t-nM})' \end{aligned} \tag{A5}$$

Finally, the vector of i.i.d. shocks in the observation equation is given by

$$u_t^* = \left(u_t^{*1}, \ u_t^{*2}, \ u_t^{*3}, \ u_t^{*4}, \ u_t^{*5}, \ u_t^{*6}, \ u_t^{*7} \right)'. \tag{A6}$$

Note that $Var(u_t^{*i}) = \sigma_i^2$,$i = 1, 2, \cdots, 7$.

The factor loadings are given in the matrix H, where

$$H = \begin{pmatrix} 0_{1*p} & \beta^{JC} & 0 & 0 & 0 \\ 0_{1*p} & 0 & \beta^{GDP} & 0 & 0 \\ 0_{1*p} & 0 & 0 & \beta^{BB} & 0 \\ 0_{1*p} & 0 & 0 & 0 & \beta^{IP} \\ 0_{1*p} & 0 & 0 & 0 & \beta^{I} \\ 0_{1*p} & 0 & 0 & 0 & \beta^{MT} \\ 0_{1*p} & 0 & 0 & 0 & \beta^{EM} \end{pmatrix} \tag{A7}$$

while the coefficients on the exogenous and predetermined variables are contained in the matrix

$$A = \begin{pmatrix} c_1^* & \gamma_{11} & & & \cdots & \gamma_{1n} & & \\ c_2^* & & \gamma_{21} & 0 & \cdots & & \gamma_{2n} & 0 \\ \vdots & & 0 & \ddots & \cdots & & 0 & \ddots \\ c_7^* & & & \cdots & \gamma_{71} & \cdots & & & \gamma_{7n} \end{pmatrix}. \tag{A8}$$

The autogressive parameters in the state equation are time varying and are contained in the matrix

$$F_t = \begin{pmatrix} \rho_1 & \cdots & \rho_{p-1} & \rho_p & 0 & 0 & 0 & 0 \\ 1 & \cdots & 0 & 0 & 0 & 0 & 0 & 0 \\ & \ddots & & \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & \cdots & 1 & 0 & 0 & 0 & 0 & 0 \\ \rho_1 & \cdots & \rho_{p-1} & \rho_p & \zeta_t^W & 0 & 0 & 0 \\ \rho_1 & \cdots & \rho_{p-1} & \rho_p & 0 & \zeta_t^Q & 0 & 0 \\ \rho_1 & \cdots & \rho_{p-1} & \rho_p & 0 & 0 & \zeta_t^{BB} & 0 \\ \rho_1 & \cdots & \rho_{p-1} & \rho_p & 0 & 0 & 0 & \zeta_t^M \end{pmatrix}. \tag{A9}$$

For the purposes of filtering, we assume the ζ_t^i is deterministic and known. This assumption is reasonable as the first day of the relevant period is known in advance. Finally, the loading matrix of the shock to the

$$Z = \begin{pmatrix} 1, & 0, & \cdots & 0, & 1, & 1, & 1, & 1 \end{pmatrix}' \tag{A10}$$

For the estimated model, the number of lagged observables was set to one ($n = 1$), the length

of the autoregressive process for x_t was set to one ($p = 1$), and $Var(\epsilon_t) = 1 - \rho^2$.

Table 1: List of the grammatical dependencies employed in the creation of the Beige Book atomic facts.

1.	NSUBJ | NSUBJPASS	Subject Noun
2.	NSUBJ | NSUBJPASS	Subject Verb
3.	DOBJ	Direct Object
4.	AMOD	Adjectival Modifier
5.	(DOBJ) AMOD	Adjectival Modifier (to the DOBJ modifier)
6.	ADVMOD	Adverbial Modifier
7.	XCOMP	Open Causal Complement
8.	(XCOMP) DOBJ	Direct Object (to the XCOMP modifier)
9.	(XCOMP) AMOD	Adjectival Modifier (to the XCOMP DOBJ modifier)
10.	(XCOMP) ADVMOD	Adverbial Modifier (to the XCOMP modifier)
11.	NEG	Negation Modifier

Table 2. Real GDP regression on Beige Book Components

Dependent variable: Real GDP growth

	Beige Book Index:				
Independent variable	AFE	PN	Key Word	SVD	Ensemble
Constant	0.440****	1.141***	0.743****	-0.284	0.159
AFE index	2.504****				-0.133
positive index		2.058			-0.975
negative index		-9.418***			0.529
"increas"			2.415***		0.239
"strong"			3.450****		-1.801
"declin"			-3.988****		-2.306
"strength"			1.360****		1.581****
"weaken"			-1.233****		-0.863***
"eas"			-0.994****		-0.920****
"recover"			0.680**		0.850***
"strike"			-0.655***		-0.716***
"borrow"			-0.743**		-0.602***
"recess"			-0.770***		-0.692**
svd1				-0.284	-0.404*
svd2				-0.327****	-0.276***
svd3				0.289***	0.341***
svd4				0.151*	0.025
svd5				-0.406****	-0.204
svd6				-0.304****	-0.093
svd7				0.104	0.096
svd8				-0.244**	-0.062
svd9				-0.034	-0.196*
svd10				-0.097	-0.047
svd11				-0.207*	0.012
svd12				0.038	-0.103
svd13				-0.106	0.063
svd14				0.173*	0.249*
svd15				-0.043	-0.096
adj-R^2	0.134	0.122	0.349	0.265	0.361
p-value for excluding:					
Key Words			2.2e-16****		5.9e-10****
SVDs				2.2e-16****	0.094*

Signif. codes: '****' 0.001 '***' 0.01 '**' 0.05 '*' 0.1

Table 3. Real GDP regressions on Beige Book Components (with lagged real GDP)

Dependent variable: real GDP growth

			Beige Book Index:		
Independent variable	AFE	PN	Key Word	SVD	Ensemble
Constant	0.169****	0.285	0.233*	-0.608	-0.362
AFE	0.683**				-0.393
positive		0.673			-0.815
negative		-2.046			1.818
"increas"			1.543***		1.875
"strong"			2.162***		-2.577
"declin"			-1.859****		-1.610*
"strength"			0.602*		1.091***
"weaken"			-0.630***		-0.452*
"eas"			-0.609***		-0.626***
"recoveri"			0.596***		0.788****
"strike"			-0.303**		-0.369**
"borrow"			-0.401**		-0.323
"recess"			-0.253		-0.231
svd1				-0.270	-0.317*
svd2				-0.157***	-0.178**
svd3				0.095	0.247**
svd4				0.105*	0.034
svd5				-0.201****	-0.029
svd6				-0.156**	-0.120
svd7				0.065	0.143
svd8				-0.154**	-0.059
svd9				-0.058	-0.233***
svd10				-0.099	-0.085
svd11				-0.007	0.135
svd12				0.042	-0.110
svd13				0.066	0.182*
svd14				0.125	0.235**
svd15				-0.056	-0.065
adj-R^2	0.517	0.513	0.571	0.547	0.583
p-values for excluding					
4 Lags of GDP	2.2e-16 ****	2.2e-16****	2.2e-16****	2.2e-16****	2.2e-16****
Key Words			3.7e-09****		1.7e-05****
SVDs				9.5e-05****	0.024**

Signif. codes: '****' 0.001 '***' 0.01 '**' 0.05 '*' 0.1

Table 4.
Mean squared prediction errors for real time ADS Indices with and without Beige Book information.

	Mean squared prediction error			Mean squared difference between full sample estimates
Sample	ADS model with Beige Book (1)	ADS model without Beige Book (2)	Ratio of (1) and (2) (3)	(4)
3/1/1990-12/31/1991	0.2710	0.3288	0.82	0.0064
12/1/2000-3/31/2002	0.2137	0.2113	1.01	0.0063
10/1/2007-12/31/2009	1.5286	1.7623	0.87	0.0072

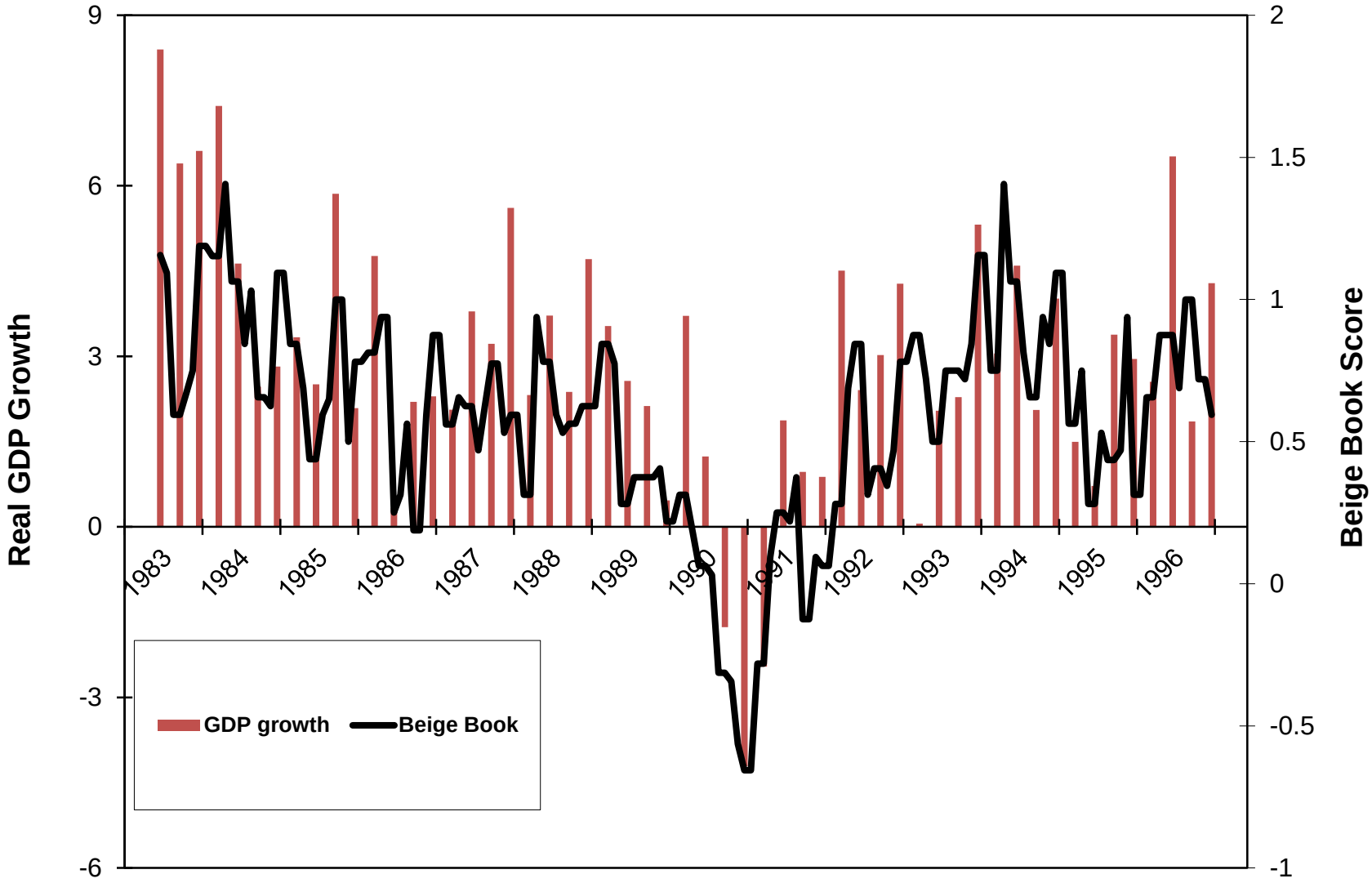
Note: The variable being forecasted is the full sample estimate of the Index of Economic Activity implied by the respective ADS models.

Table A1.

Full sample parameter estimates of ADS model with Beige Book index included.

Parameter	Estimate	Standard error	t-stat
β_{JC}	0.007	9.31E-04	-7.24
β_{GDP}	0.010	9.35E-04	10.9
$\beta_{Beige\ Book}$	0.012	1.47E-03	7.87
β_{IP}	0.032	2.41E-03	13. 1
$\beta_{personal\ income}$	0.015	1.76E-03	8.74
$\beta_{manufacturing}$	0.026	2.09E-03	12.3
$\beta_{employment}$	0.022	1.80E-03	12. 4
γ_{JC}	0.950	5.75E-03	1.65
γ_{GDP}	0.059	5.91E-02	-0.993
$\gamma_{Beige\ Book}$	0.340	4.91E-02	6.92
γ_{IP}	-0.193	4.37E-02	-4.42
$\gamma_{personal\ income}$	0.199	4.21E-02	-4.72
$\gamma_{manufacturing}$	0.420	3.91E-02	-10.7
$\gamma_{employment}$	0.252	4.22E-02	5.96
σ_{JC}	0.234	3.45E-03	67.7
σ_{GDP}	0.638	3.78E-02	16.9
$\sigma_{Beige\ Book}$	0.722	2.69E-02	26.8
σ_{IP}	0.608	2.96E-02	20.5
$\sigma_{personal\ income}$	0.905	2.86E-02	31.7
$\sigma_{manufacturing}$	0.745	2.72E-02	27.3
$\sigma_{employment}$	0.577	2.14E-02	27.0
ρ	0.989	1.29E-03	769.8

Figure 1. Real GDP Growth and Balke-Petersen Beige Book Index
(Average of National Sectors)



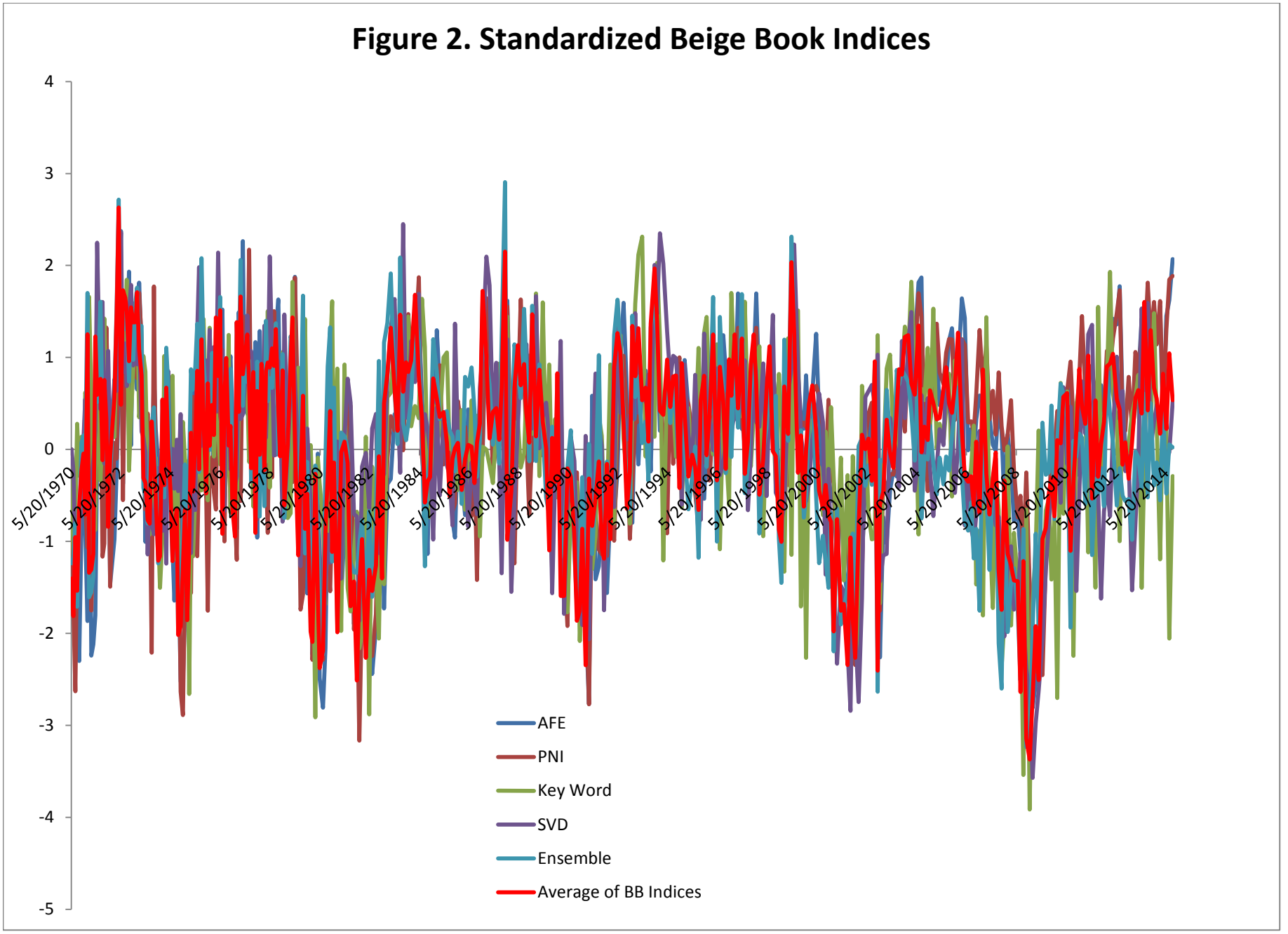


Figure 2. Standardized Beige Book Indices
4
3
2
1
0
-1
-2
-3
-4
-5
5/20/1970
5/20/1972
5/20/1974
5/20/1976
5/20/1978
5/20/1980
5/20/1982
5/20/1984
5/20/1986
5/20/1988
5/20/1990
5/20/1992
5/20/1994
5/20/1996
5/20/1998
5/20/2000
5/20/2002
5/20/2004
5/20/2006
5/20/2008
5/20/2010
5/20/2012
5/20/2014
AFE
PNI
Key Word
SVD
Ensemble
Average of BB Indices

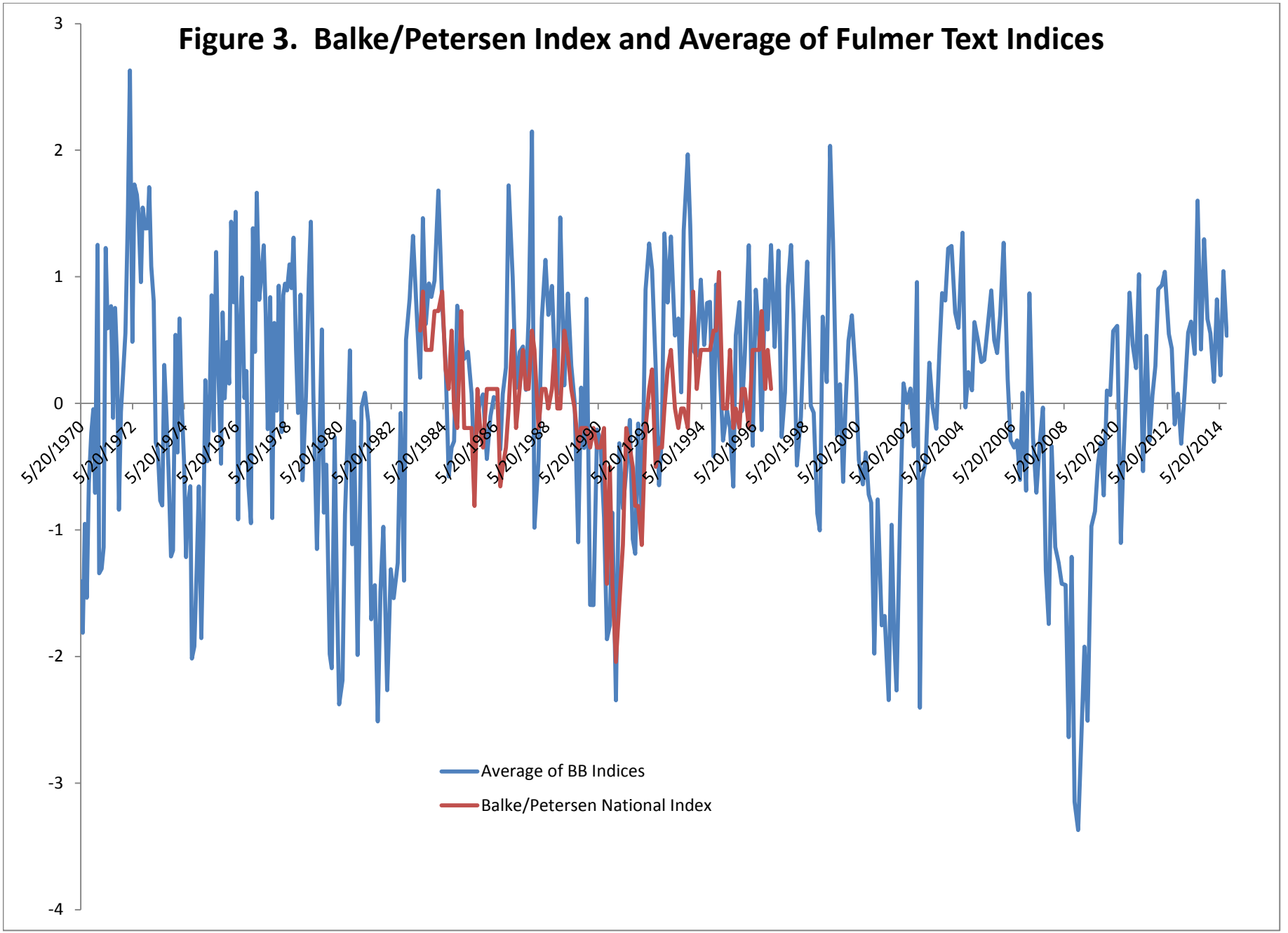


Figure 3. Balke/Petersen Index and Average of Fulmer Text Indices
3
2
1
0
-1
-2
-3
-4
5/20/1970
5/20/1972
5/20/1974
5/20/1976
5/20/1978
5/20/1980
5/20/1982
5/20/1984
5/20/1986
5/20/1988
5/20/1990
5/20/1992
5/20/1994
5/20/1996
5/20/1998
5/20/2000
5/20/2002
5/20/2004
5/20/2006
5/20/2008
5/20/2010
5/20/2012
5/20/2014
Average of BB Indices
Balke/Petersen National Index

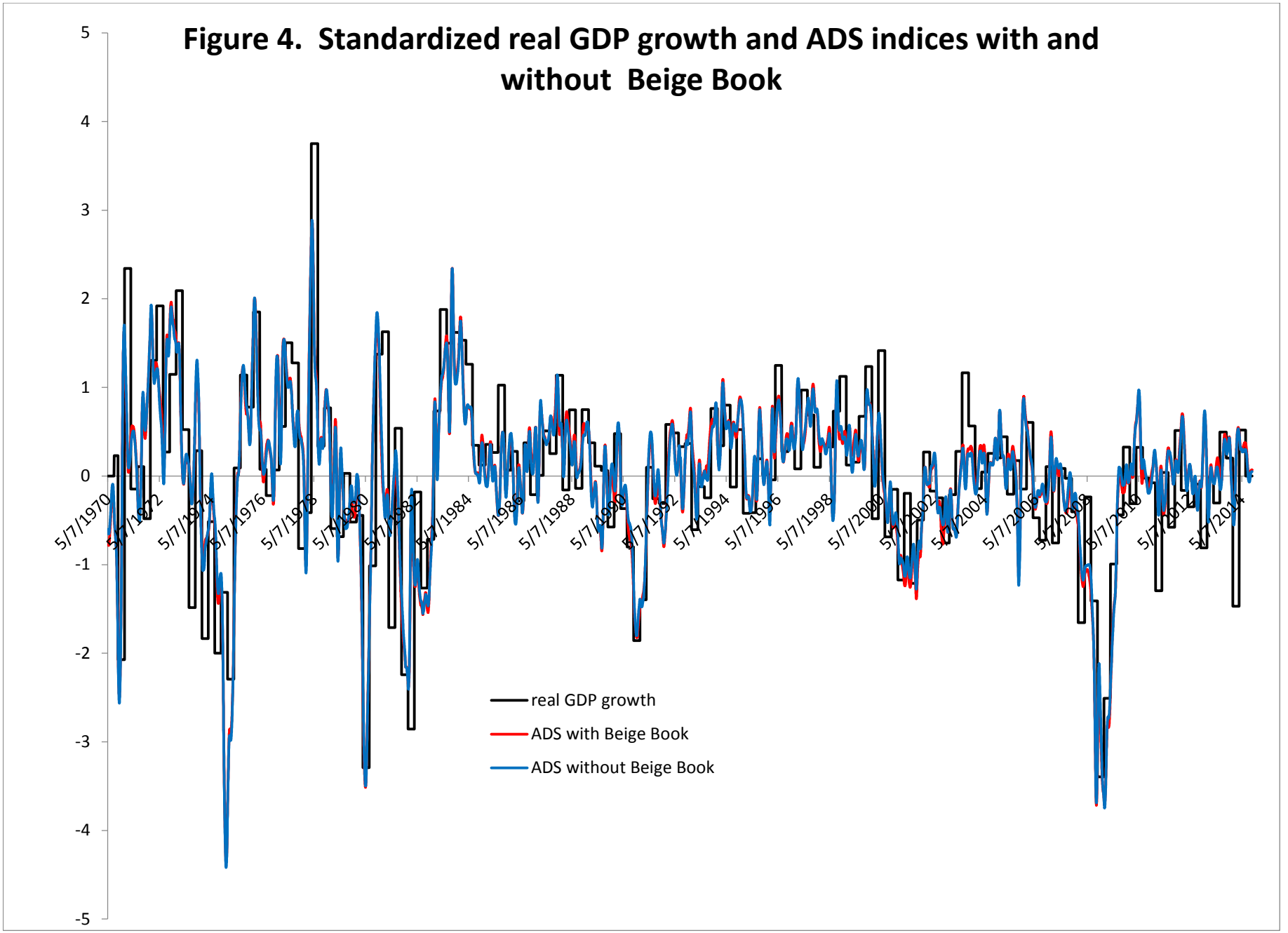


Figure 4. Standardized real GDP growth and ADS indices with and without Beige Book
5
4
3
2
1
0
-1
-2
-3
-4
-5
5/7/1970
5/7/1972
5/7/1974
5/7/1976
5/7/1978
5/7/1980
5/7/1982
5/7/1984
5/7/1986
5/7/1988
5/7/1990
5/7/1992
5/7/1994
5/7/1996
5/7/1998
5/7/2000
5/7/2002
5/7/2004
5/7/2006
5/7/2008
5/7/2010
5/7/2012
5/7/2014
real GDP growth
ADS with Beige Book
ADS without Beige Book

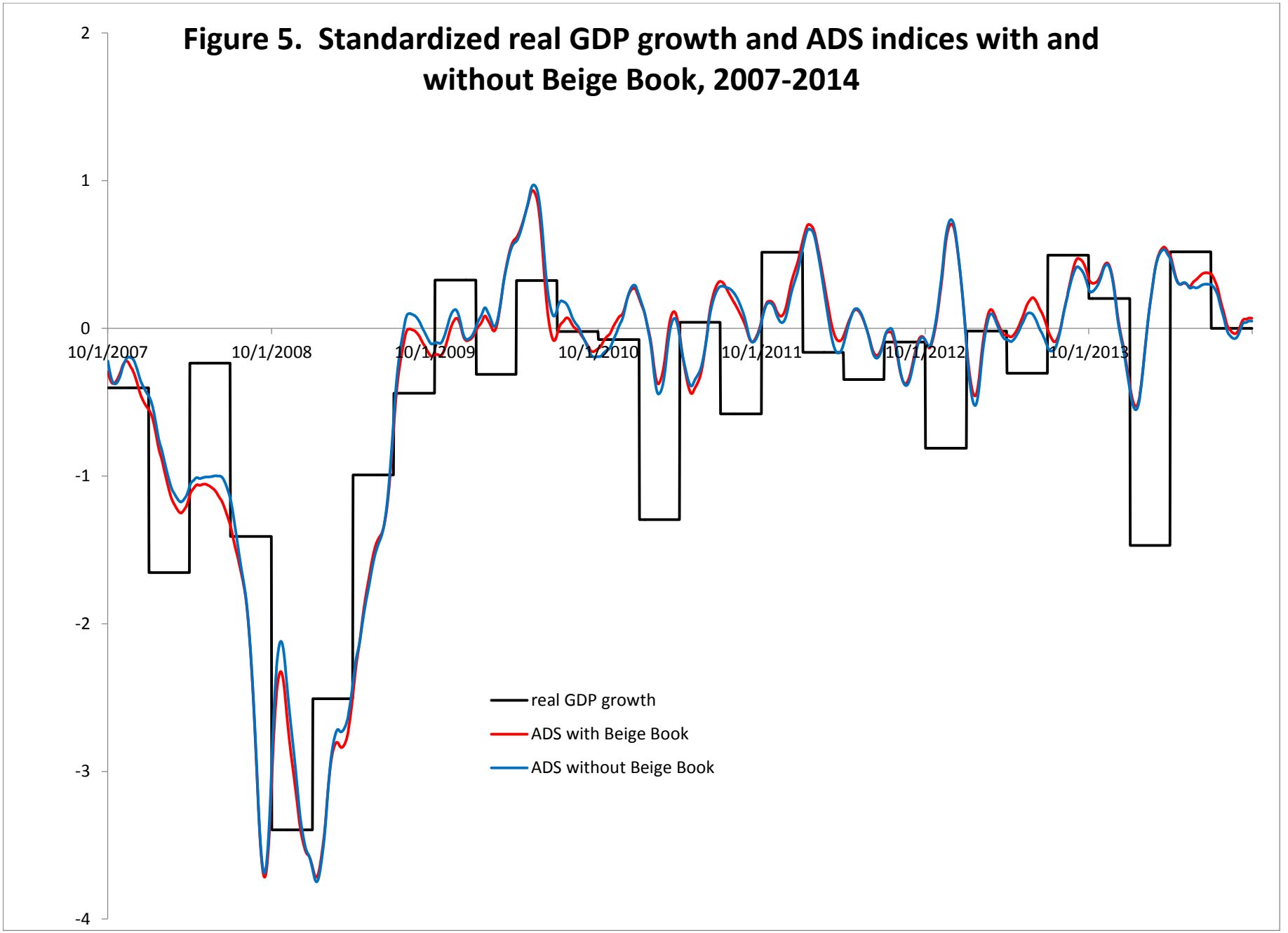


Figure 5. Standardized real GDP growth and ADS indices with and without Beige Book, 2007-2014
2
1
0
-1
-2
-3
-4
10/1/2007
10/1/2008
10/1/2009
10/1/2010
10/1/2011
10/1/2012
10/1/2013
real GDP growth
ADS with Beige Book
ADS without Beige Book

Figure 6. ADS Index without BB on the day BB is released

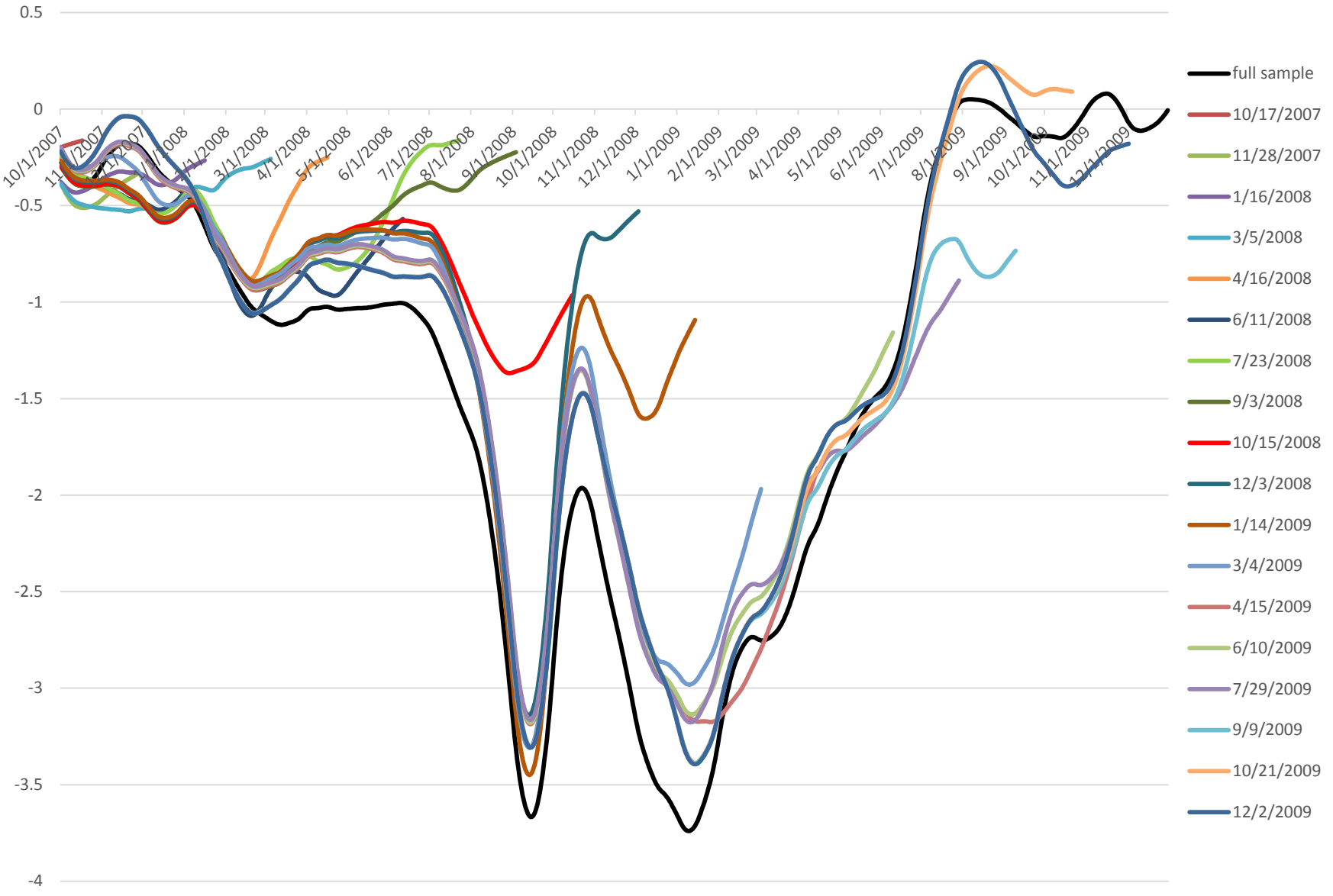


Figure 7. ADS Index with BB on the day BB is released

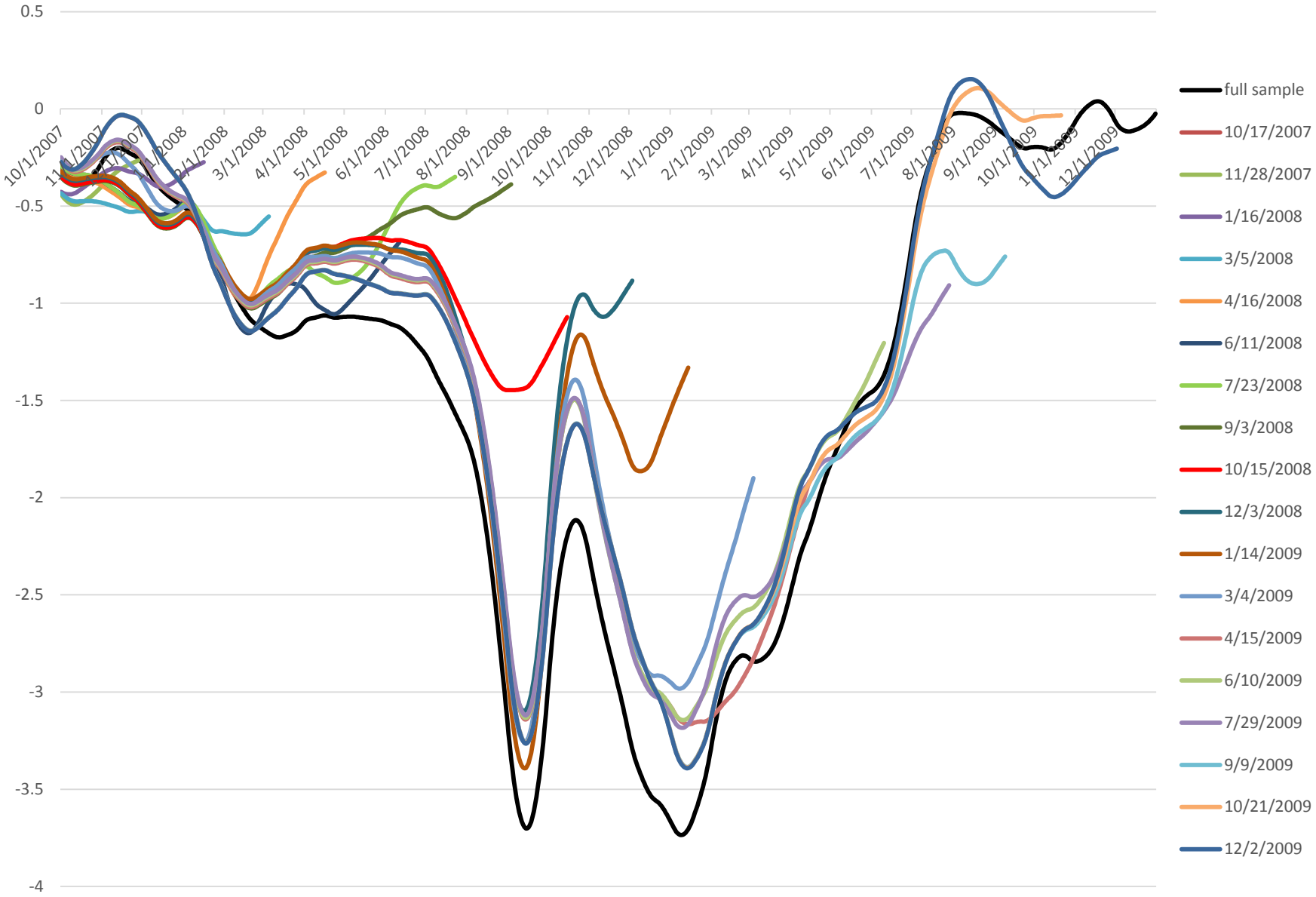


Figure 8. ADS Index without BB on the day BB is released

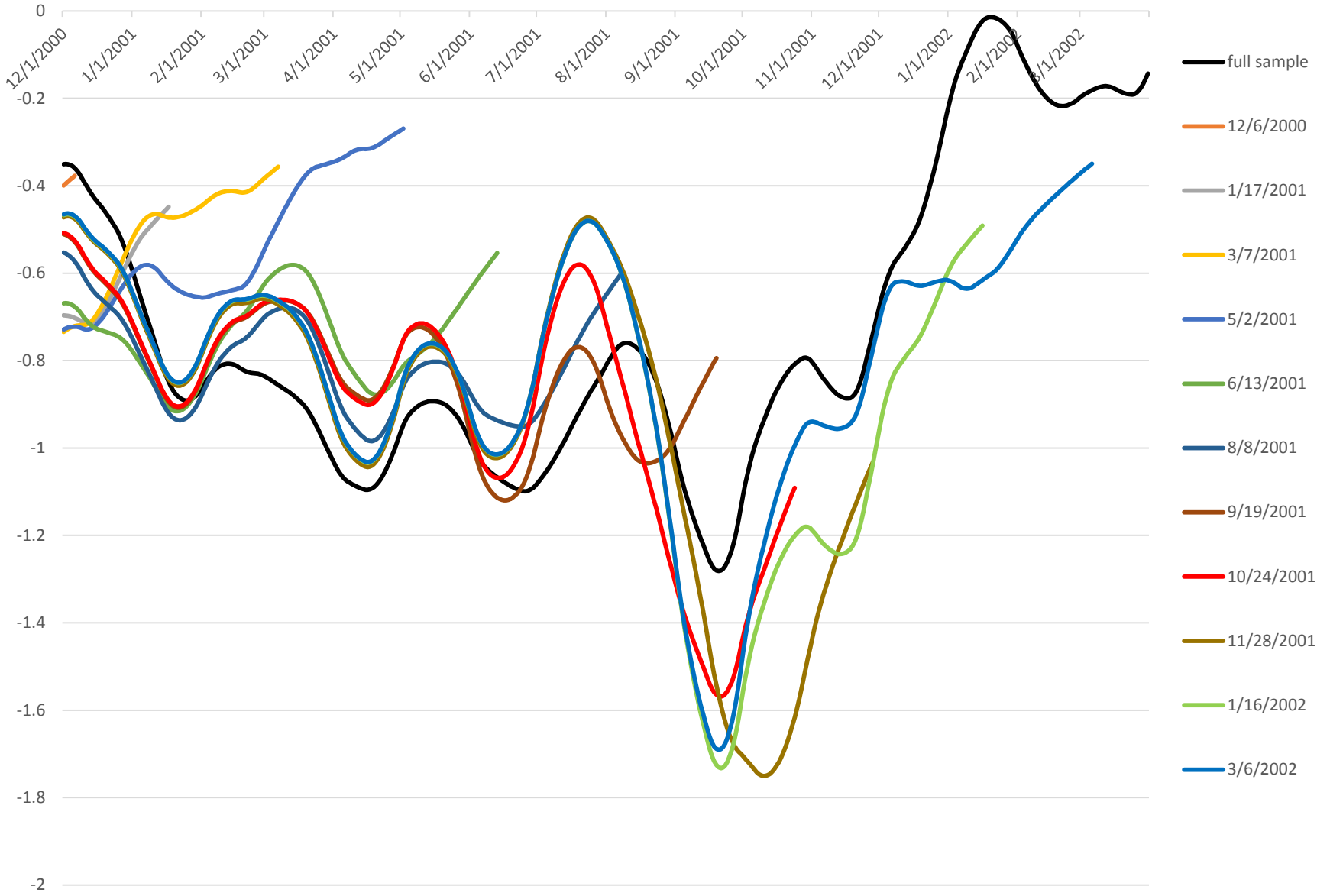


Figure 9. ADS Index with BB on the day BB is released

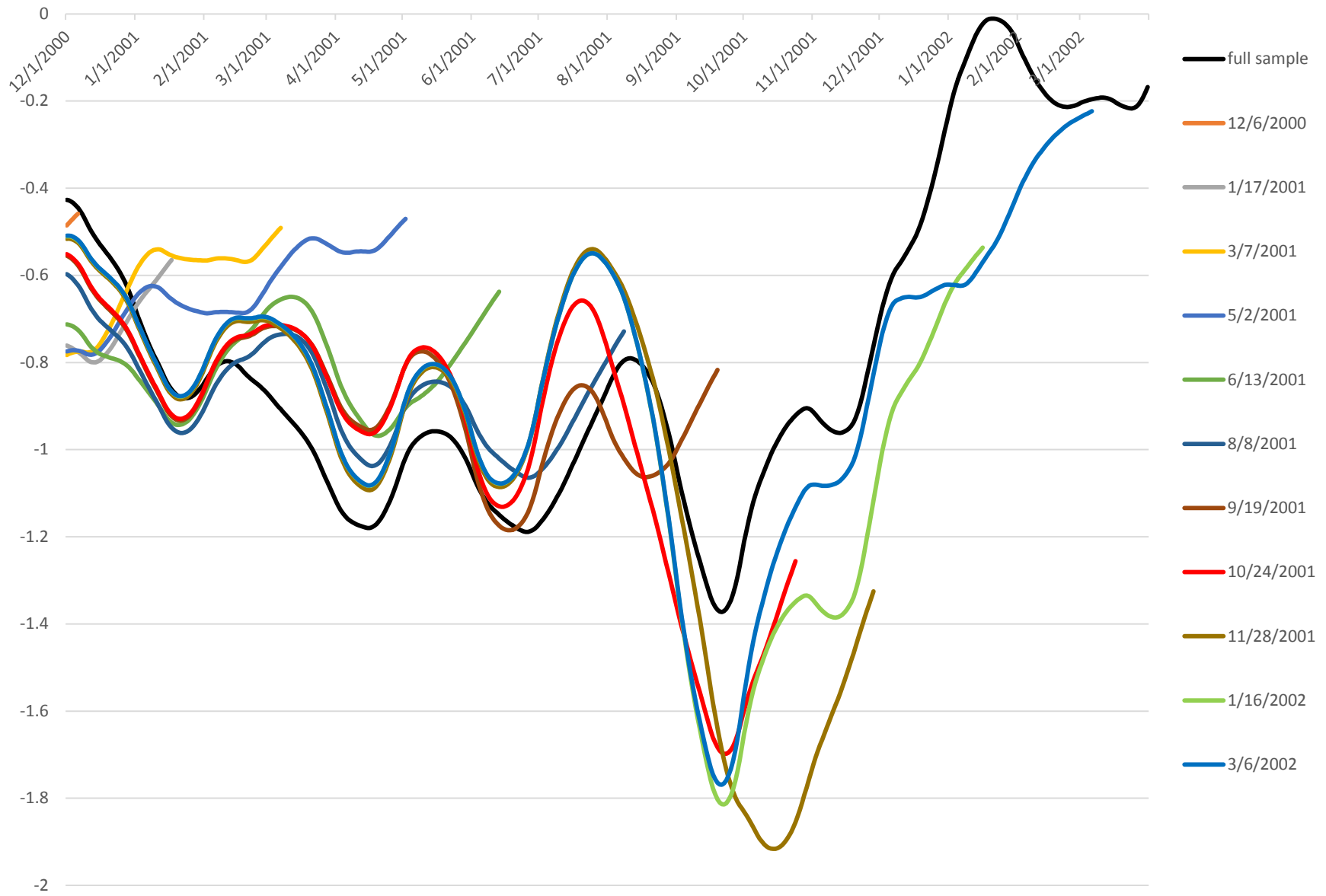


Figure 10. ADS Index without BB on the day BB is released

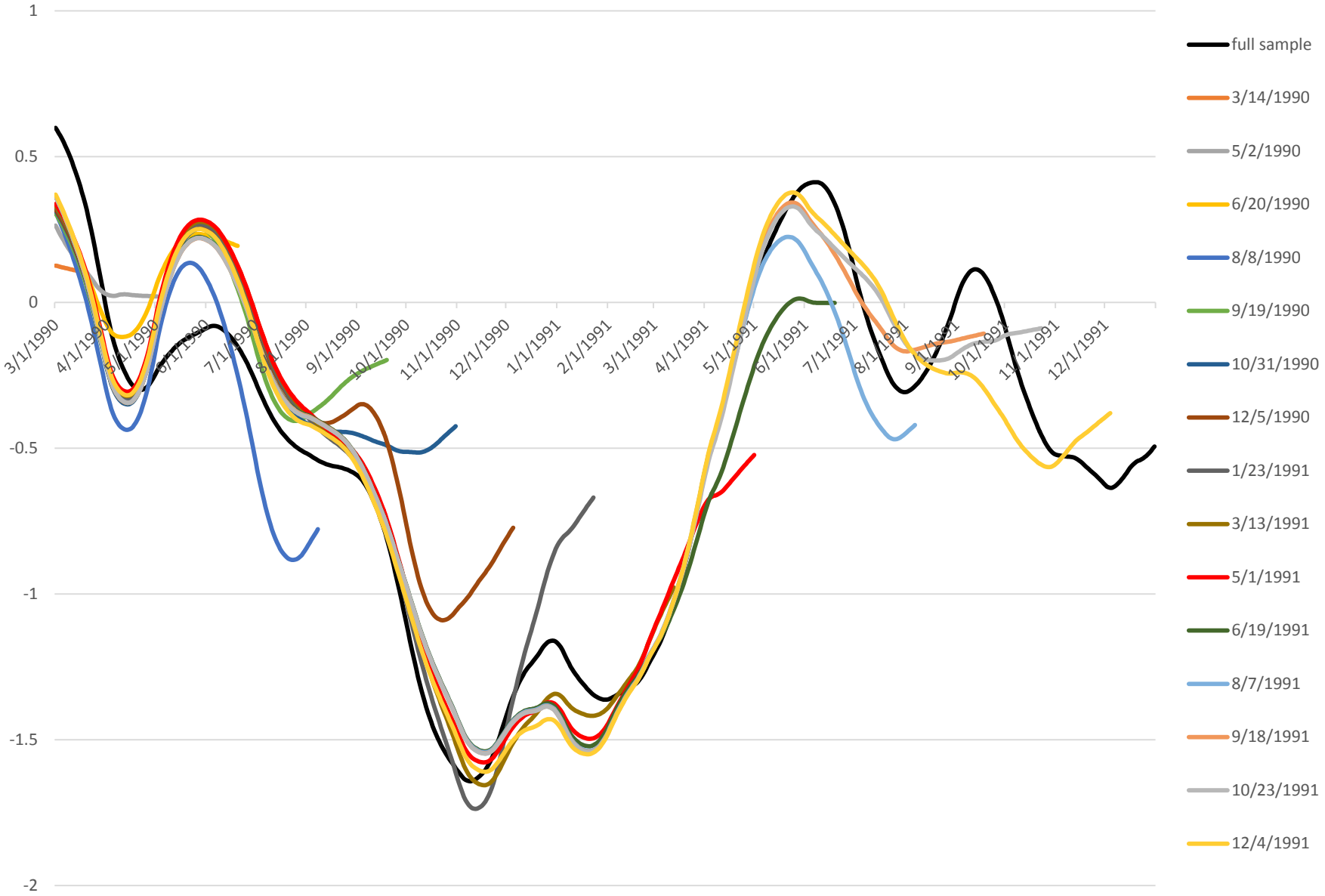


Figure 11. ADS Index with BB on the day BB is released

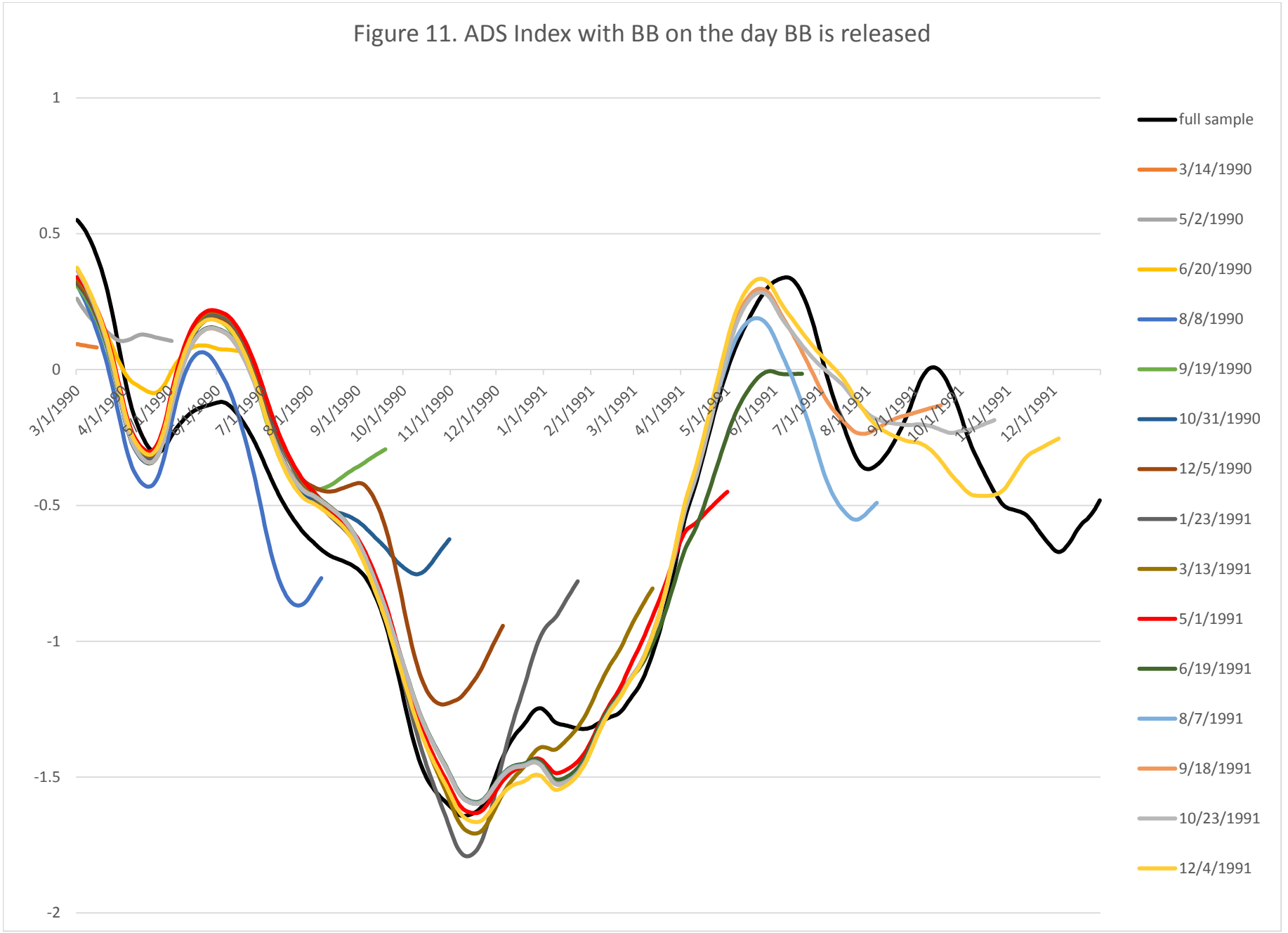


Figure 12.
Relative performance of including the Beige Book at forecasting the full sample estimate of the ADS index of economic activity.

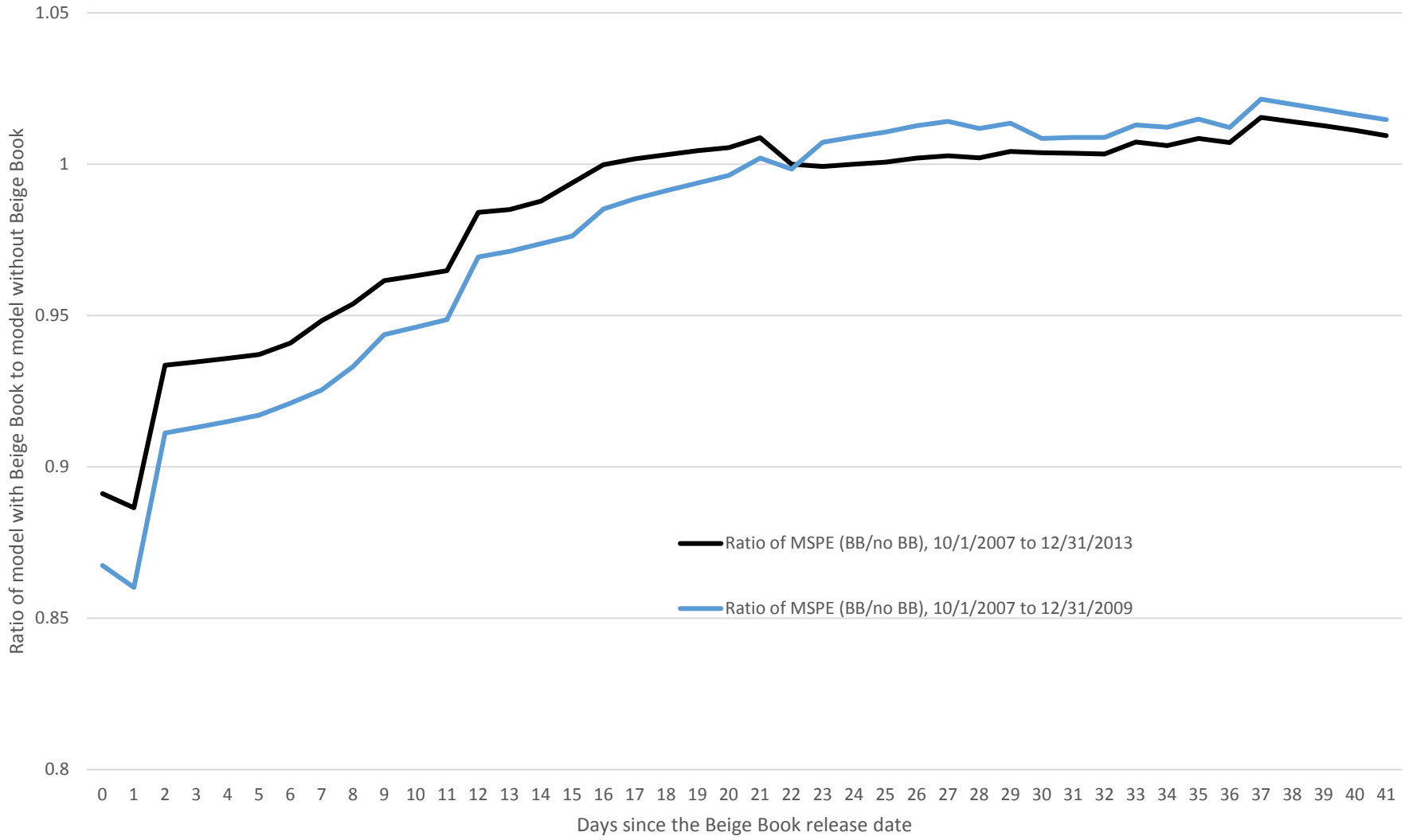


Figure 13.
Relative performance of models with Beige Book and without Beige Book of forecasting current quarter real GDP growth. Sample period: 10/1/2007 - 12/31/2013.

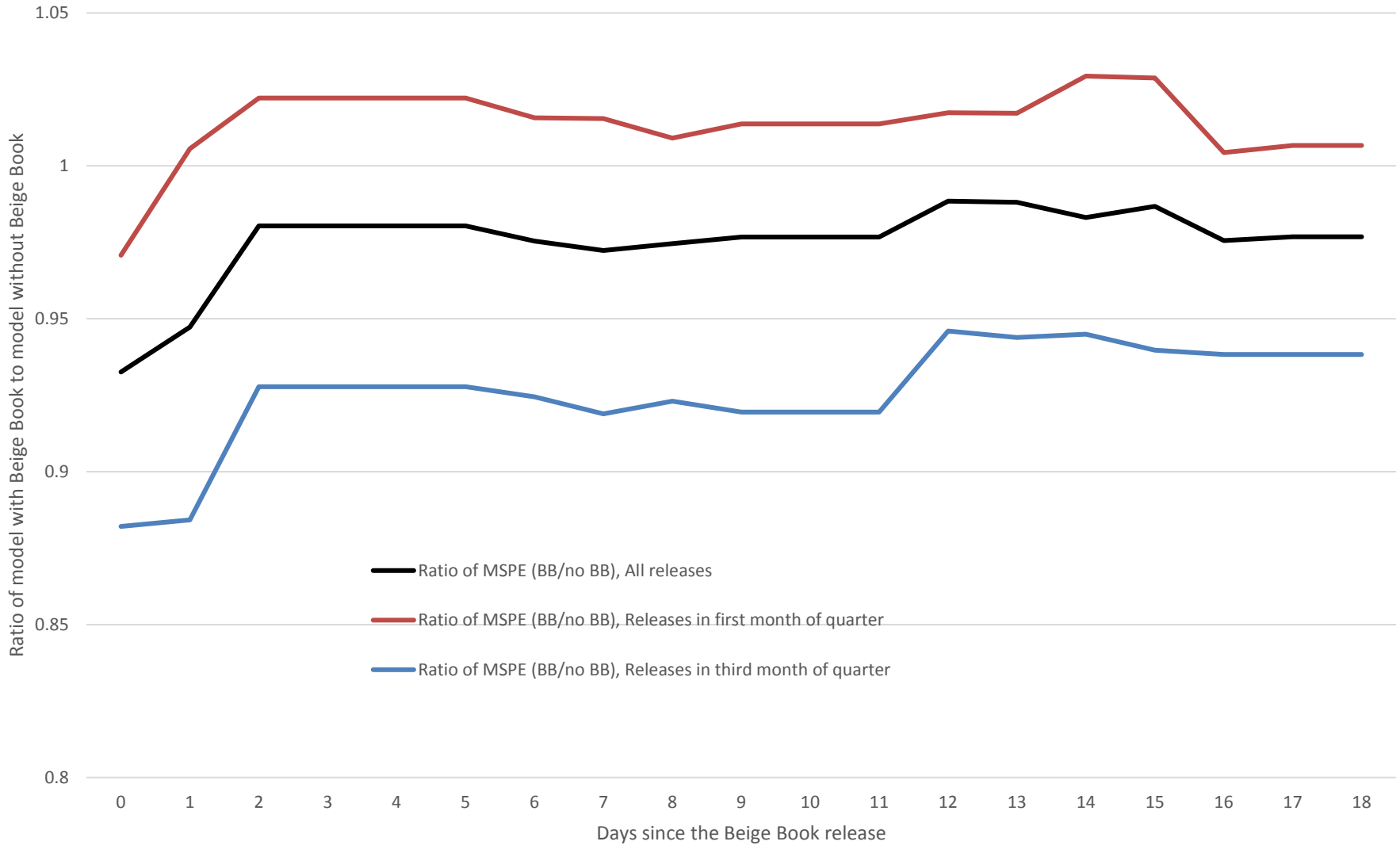


Figure 14.
Relative performance of models with Beige Book and without Beige Book of forecasting current quarter real GDP growth. Sample period: 10/1/2007 - 12/31/2009.