Forecasting Business and Stock Market Cycles and Industry Growth

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About Us

- Founded in January 2013.
- Develop models to forecast reversals in the stock market cycle in the U.S, reversals in the business cycle in the U.S. and Canada, and real GDP and employment growth by industry in Canada.
- Five monthly Reports:
  - Outlook on the business cycle in the U.S. for next three months
  - Outlook on the business cycle in Canada for next three months
  - Outlook on the stock market cycle in the U.S. for next two months
  - Real GDP outlook for 35 industries in Canada for current and next year
  - Employment outlook for 32 industries in Canada for current and next year.
- A research paper is associated with each Report. The research papers can be obtained free from the website.

U.S. Business Cycle Model

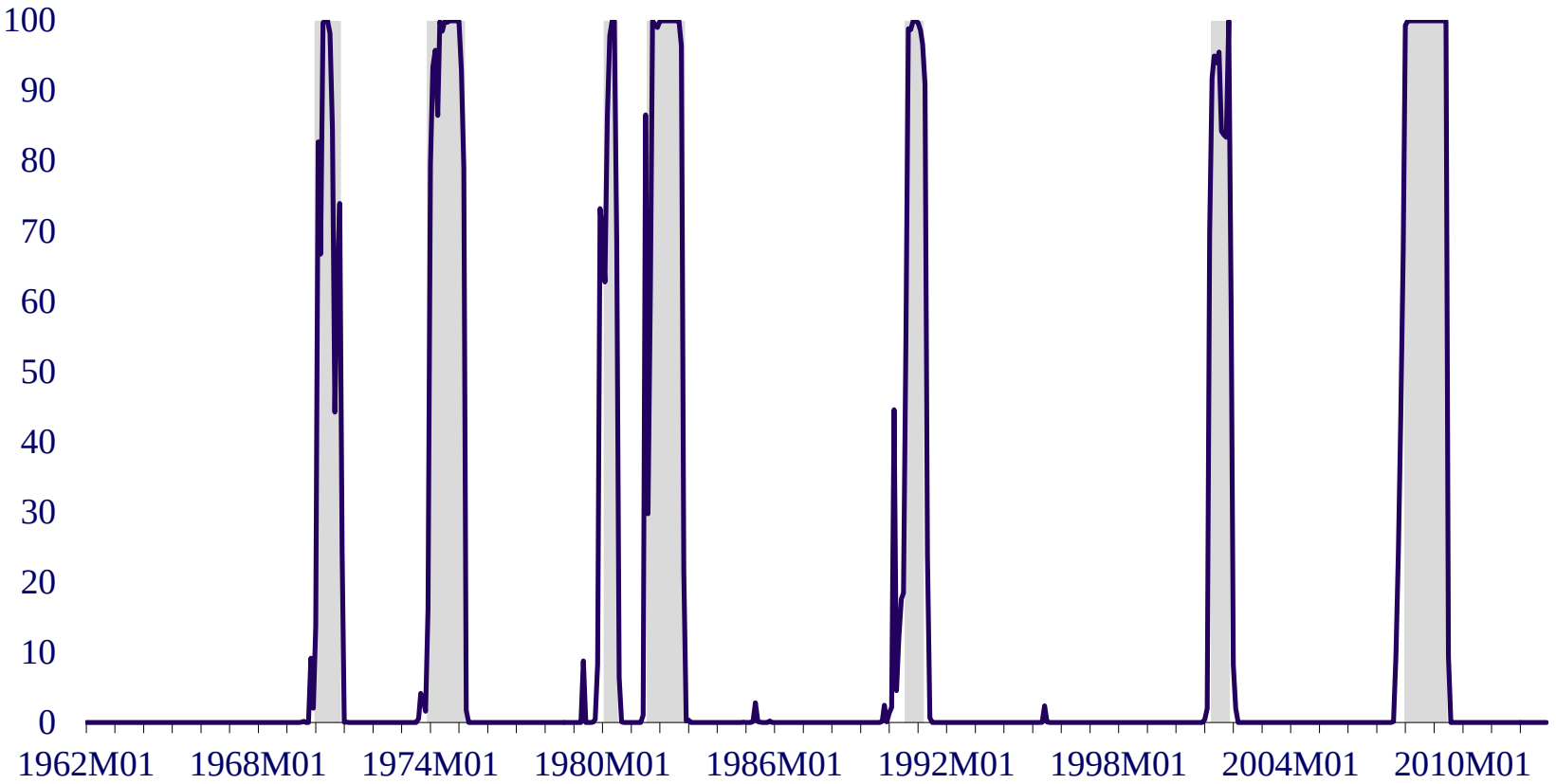
Model

- The U.S. business cycle is characterised by two phases: expansion and recession.
- The static probit modeling approach is used to calculate the probability of a reversal in the U.S. business cycle between expansion and recession phases. Lagged values of the state of the business cycle or (and) lagged values of the probability function is (are) not included in the model.
- The model is estimated with monthly data from January 1962 and it includes a number of U.S. economic indicators, such as building permits, initial claims, consumer sentiment, and the yield curve.
- The predicted outcome for the business cycle is determined using the usual 50% threshold:
  - When the economy is an expansion, the model predicts a reversal to a recession if the probability is equals to or exceeds 50%.[1] Otherwise, the model predicts that the expansion will continue.
  - When the economy is a recession, the model predicts a reversal to an expansion if the probability is equals to or falls below 50%.[1] Otherwise, the model predicts that the recession will continue.
- Figure 1 (next slide) illustrates the monthly evolution of the probability of the U.S. being in a recession (identified by the blue line) along with the recession periods (grey shaded areas).

1. It is possible that an increase (decline) in the probability to above (below) 50% could be explained by a limited number of the model's predictive variables. When the model signals of a reversal in the business cycle, the source of the change in the probability is investigated in order to reduce the risk of a false alarm.

Figure 1: Probability of the U.S. Being in a Recession[1]: January 1962 - December 2013

(probability, %)

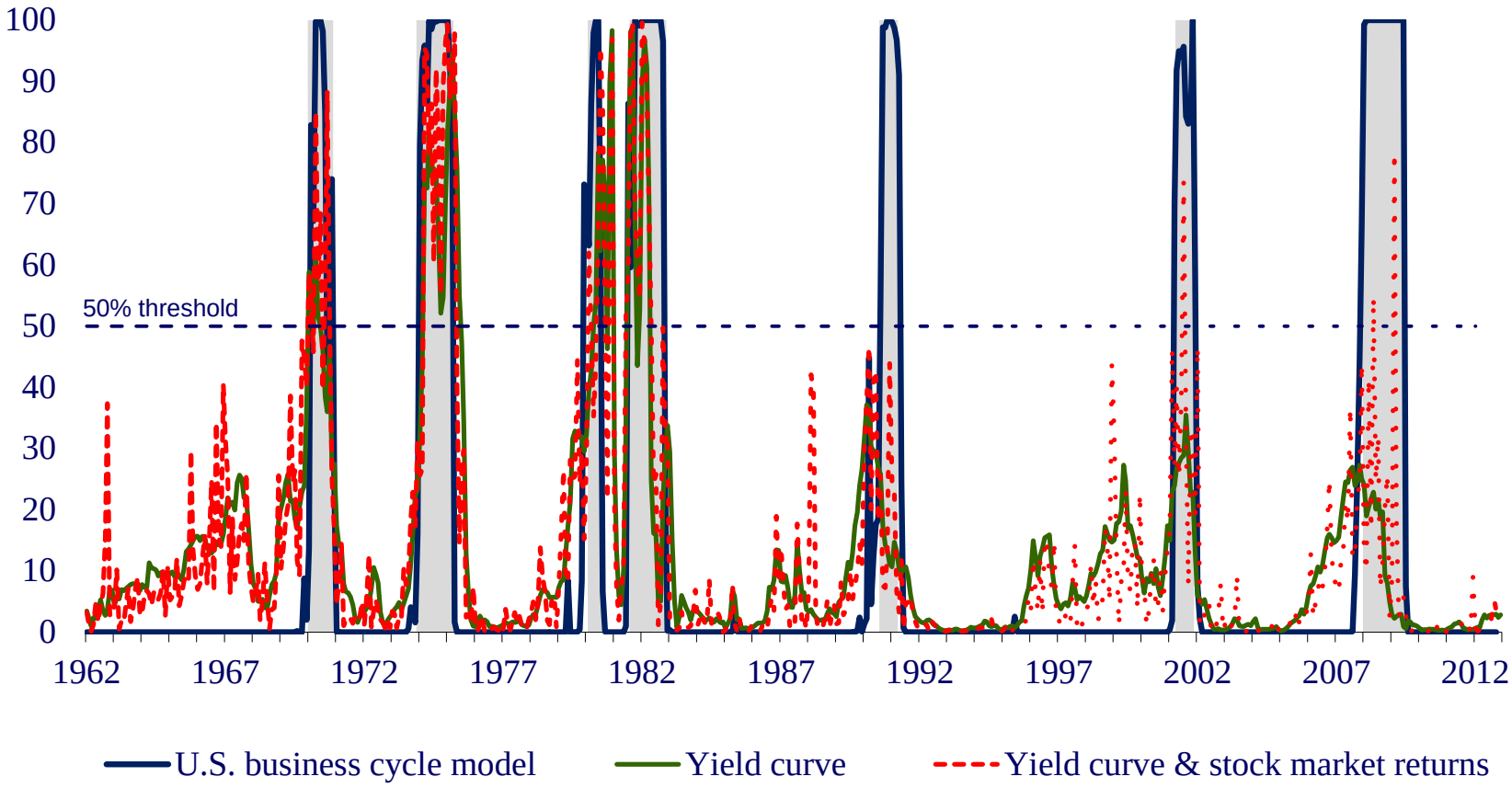


Source: The Forecasting Advisor.

1. The in-sample probability were computed with the one-month ahead probit model. Shaded areas indicate recessions, as dated by the NBER.

Figure 2: Probability of the U.S. Being in a Recession: U.S. Business Cycle Model Versus Two Well-Know Specifications

(probability, %)



Source: The Forecasting Advisor. Shaded areas indicate recessions.

Table 1
Some Key Probit Estimation Output for the U.S. Business Cycle Model [1]

Model	McFadden R-square	
Model	**0.89**	
Alternative probit models:		
Yield curve	**0.32**	
Yield curve + stock market returns	**0.40**	
Kauppi & Saikkonen (2008)	**0.20 to 0.58[2]**	
Wright (2006)	**0.22 to 0.50**	
Nyberg (2013)	**0.29 to 0.84[2]**	
Kauppi (2008)	**0.23 to 0.68[2]**	
Prediction Evaluation (Success rate based on the 50% rule)	**In-Sample[3]**	**Out-of-Sample[4]**
Predicted / Total Recession Months	**78 / 83 (94%)**	**24 / 24 (100%)**
Predicted / Total Expansion Months	**529 / 536 (99%)**	**251 / 259 (97%)**

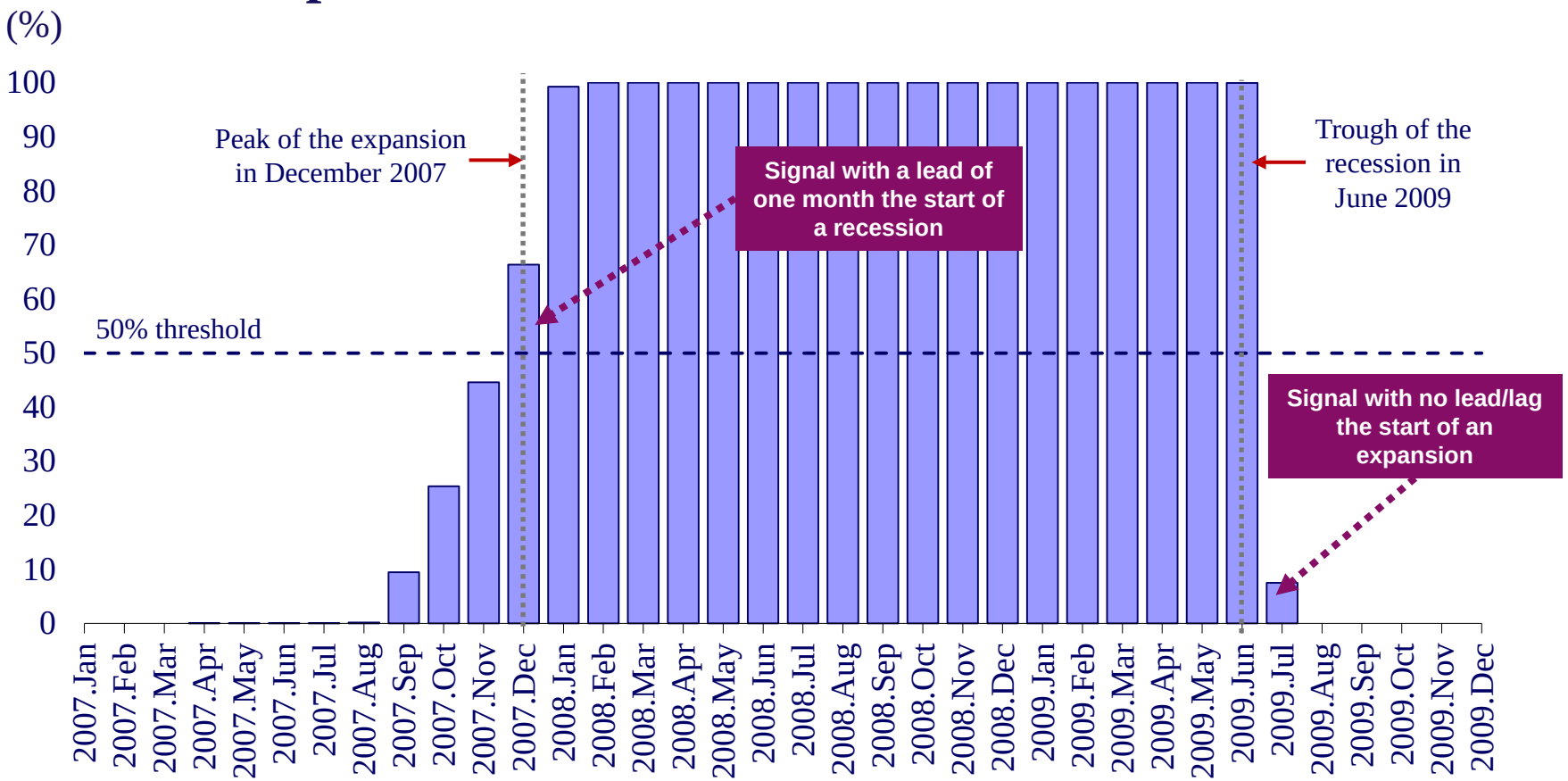
1. The results for the U.S. business cycle model are from the one-month ahead probability model.
2. The highest values are obtained with autoregressive and dynamic and autoregressive probit models.
3. Based on an estimation period of January 1962 to July 2013.
4. Based on an estimation period of January 1962 to December 1989. The out-of-sample starts in January 1990.

Table 2
Performance of the Model in Predicting the Reversals in the Business Cycle in the U.S. since 1962[1]

Business Cycle Reference Dates[2]		Lead (-) / Lag(+) in Predicting the Start of the Recession (in months)	Lead(-) / Lag(+) in Predicting the Start of the Expansion (in months)
Peak	Trough		
December 1969	November 1970	+1	0
November 1973	March 1975	+1	0
January 1980	July 1980	-2	0
July 1981	November 1982	-1	-1
July 1990	March 1991	0	+1
March 2001	November 2001	-1	+1
December 2007	June 2009	-1	0
Average		-0.43	+0.14

1. The results are based on the one-month ahead probability model.
2. The reference dates are from the NBER.

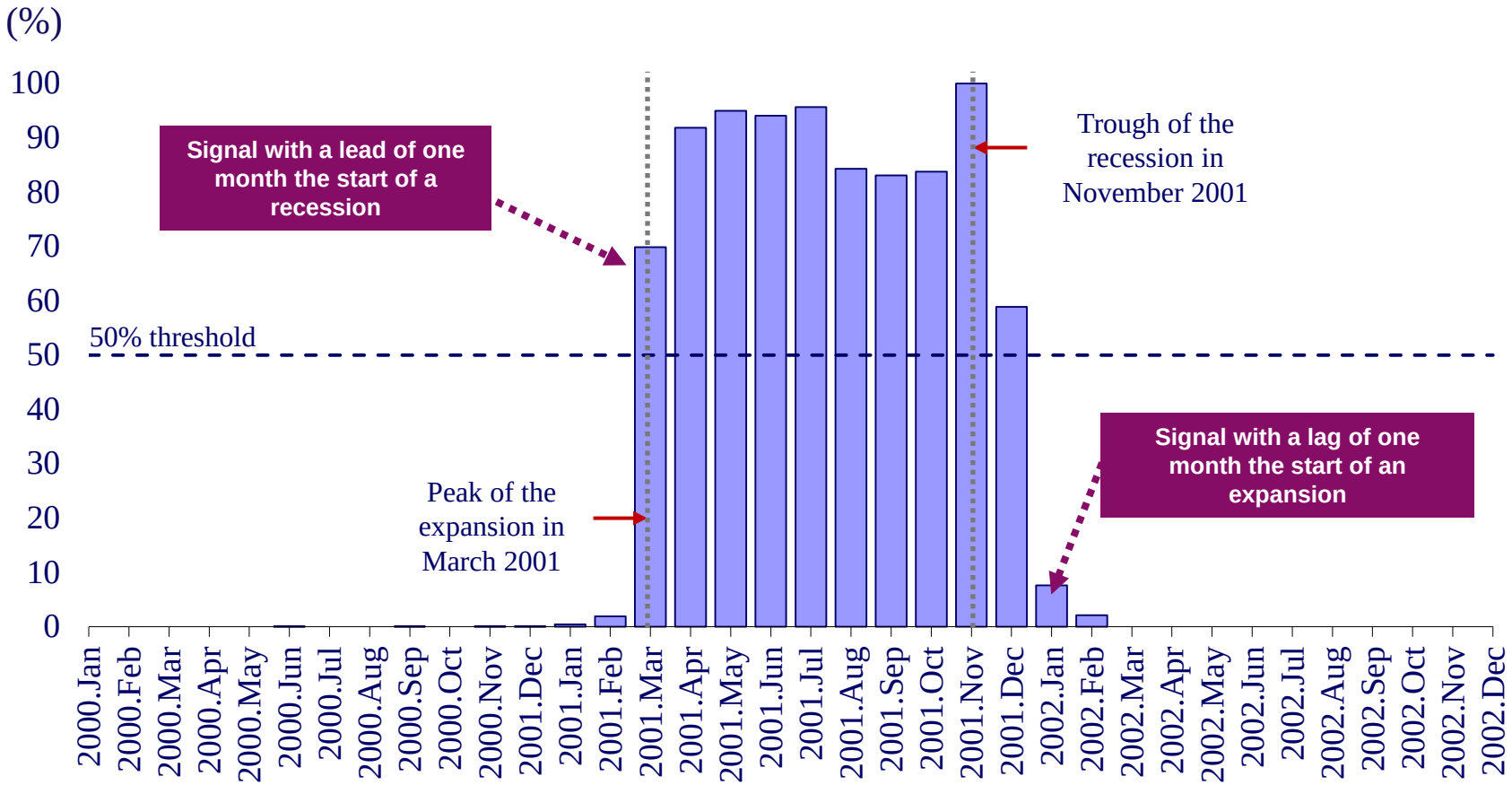
Figure 3: Probability of the U.S. Being in a Recession: 2008-2009 Episode[1]



Source: The Forecasting Advisor.

1. In-sample probabilities from the one-month ahead probability model.

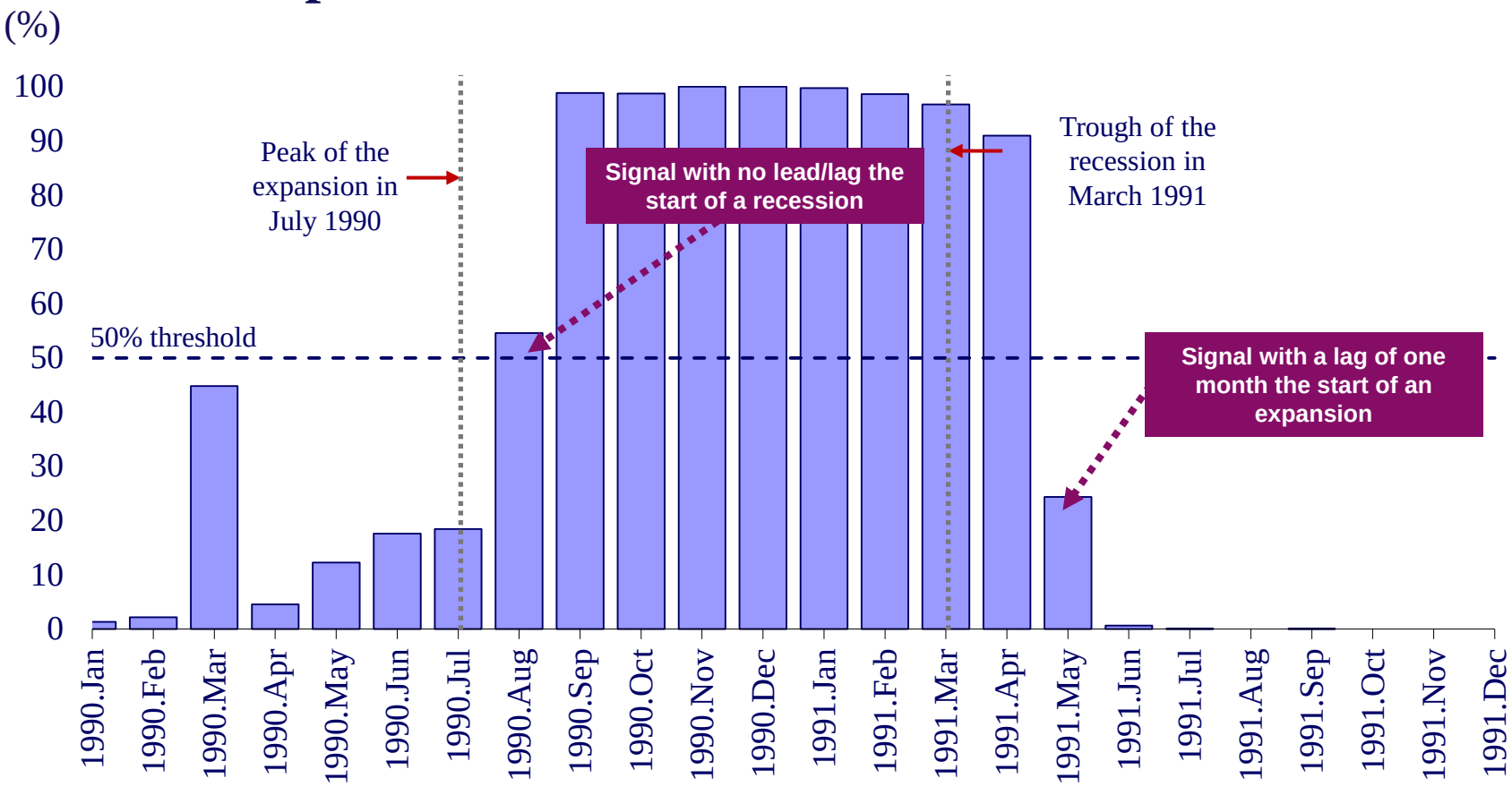
Figure 4: Probability of the U.S. Being in a Recession: 2001 Episode[1]



Source: The Forecasting Advisor.

1. In-sample probabilities from the one-month ahead probability model.

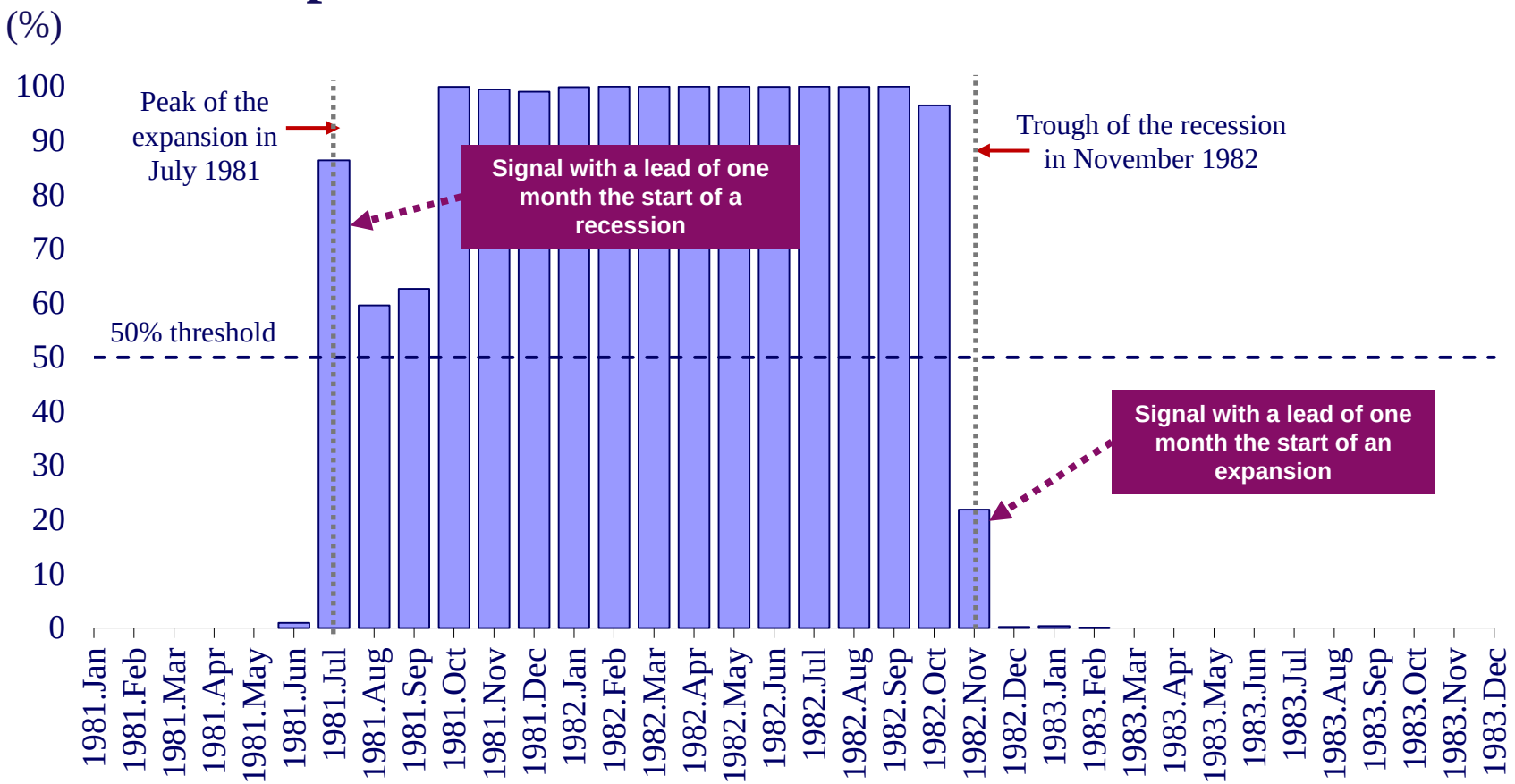
Figure 5: Probability of the U.S. Being in a Recession: 1990-1991 Episode[1]



Source: The Forecasting Advisor.

1. In-sample probabilities from the one-month ahead probability model.

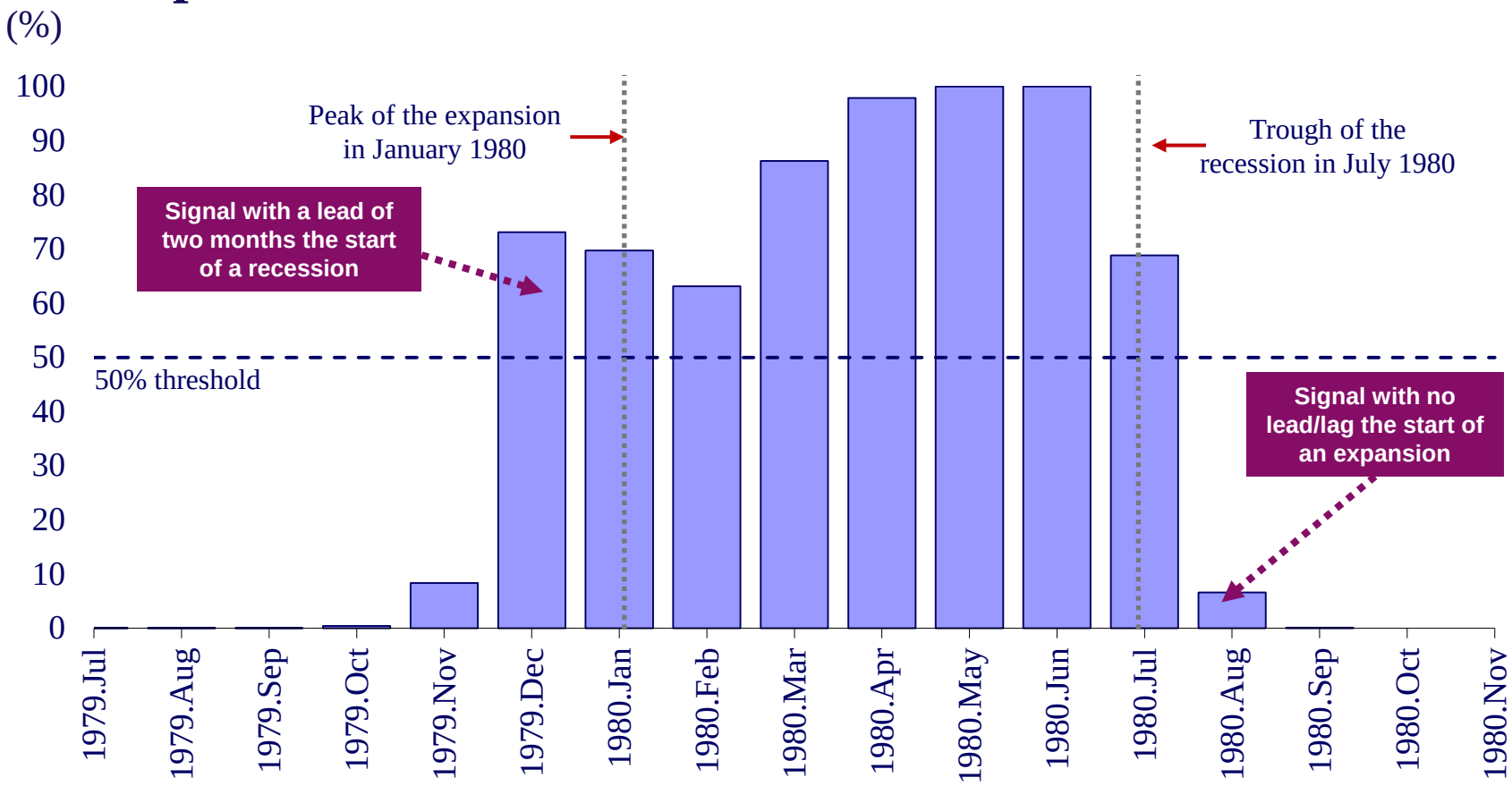
Figure 6: Probability of the U.S. Being in a Recession: 1981-1982 Episode[1]



Source: The Forecasting Advisor.

1. In-sample probabilities from the one-month ahead probability model.

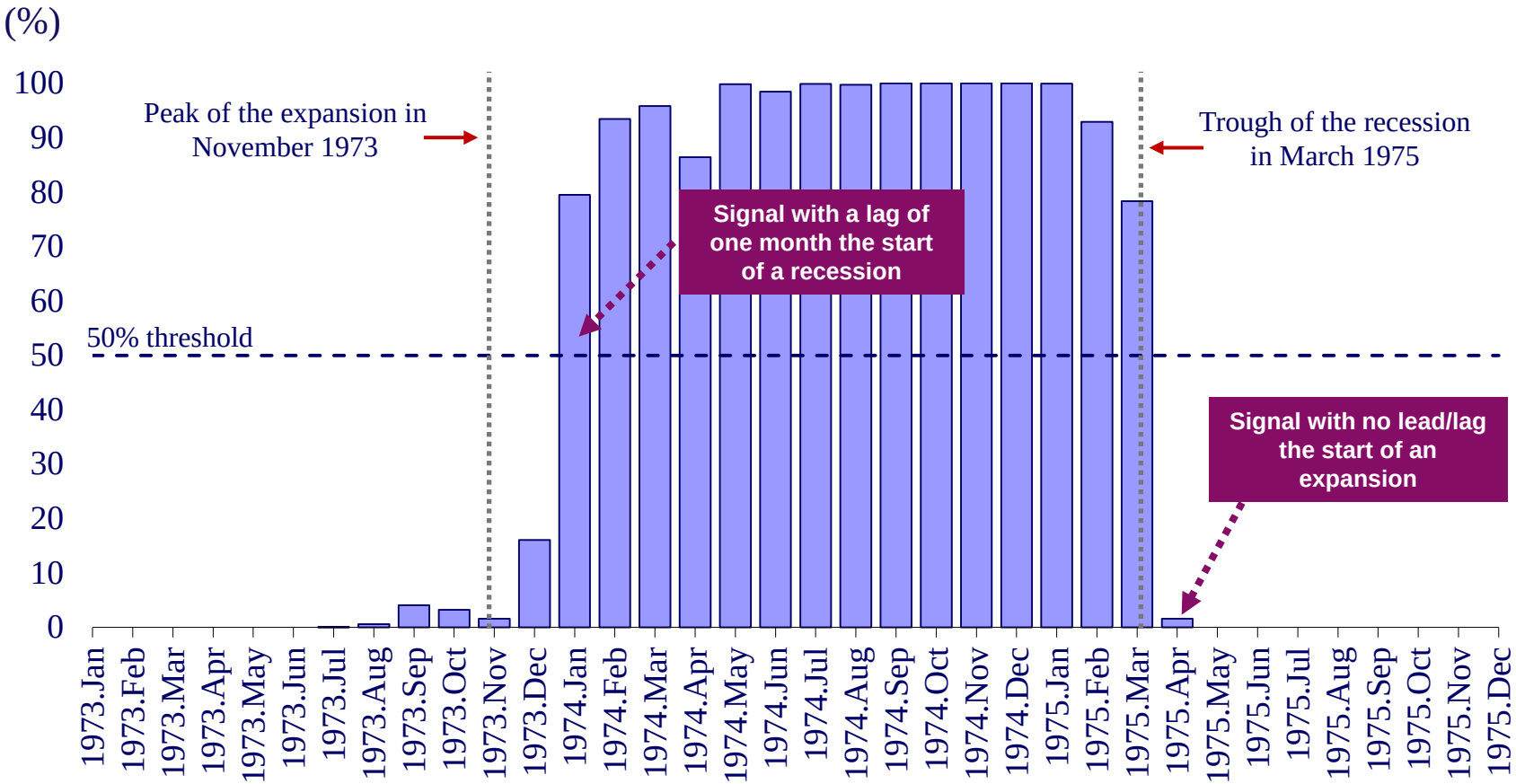
Figure 7: Probability of the U.S. Being in a Recession: 1980 Episode[1]



Source: The Forecasting Advisor.

1. In-sample probabilities from the one-month ahead probability model. .

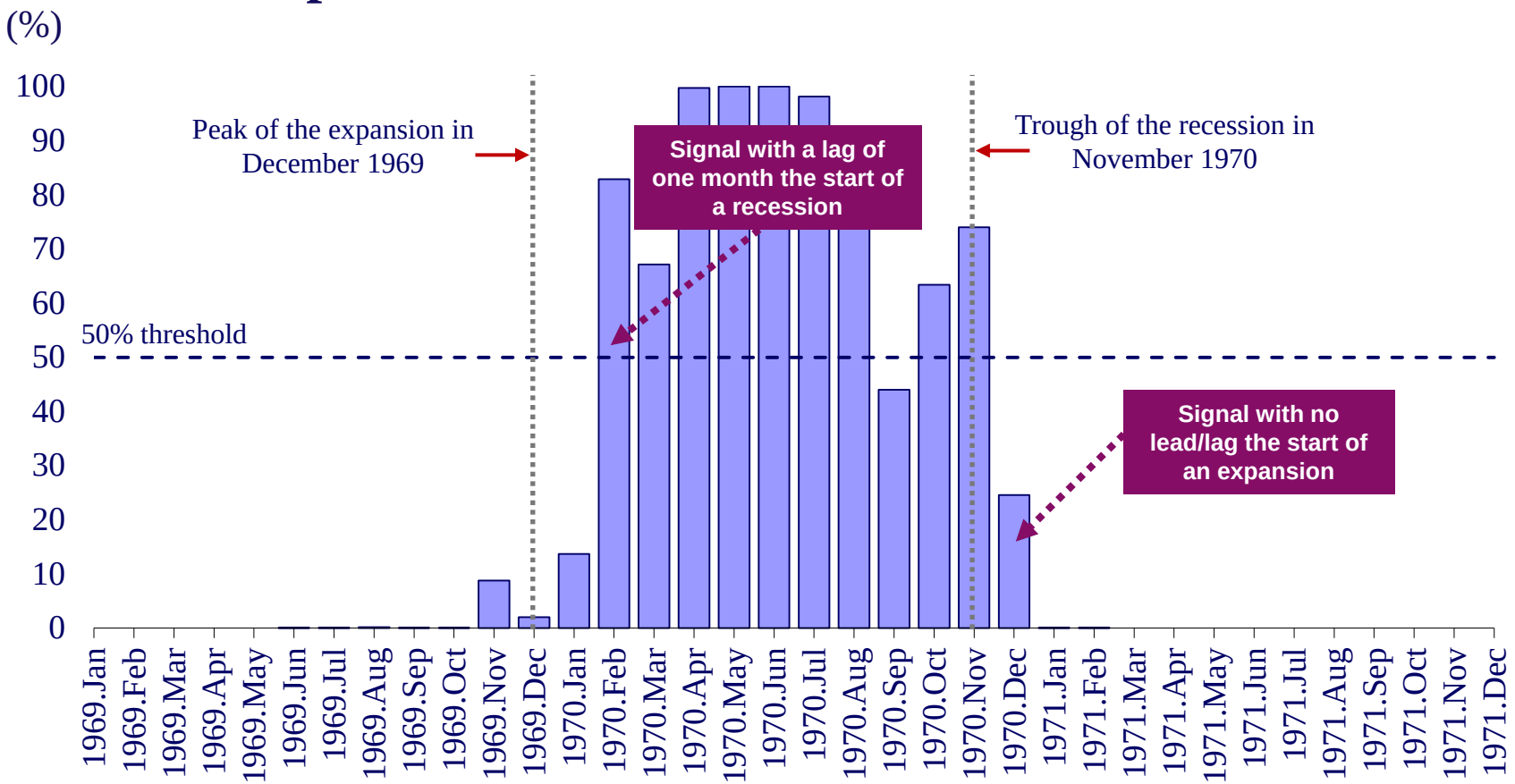
Figure 8: Probability of the U.S. Being in a Recession: 1973-1975 Episode[1]



Source: The Forecasting Advisor.

1. In-sample probabilities from the one-month ahead probability model.

Figure 9: Probability of the U.S. Being in a Recession: 1969-1970 Episode[1]

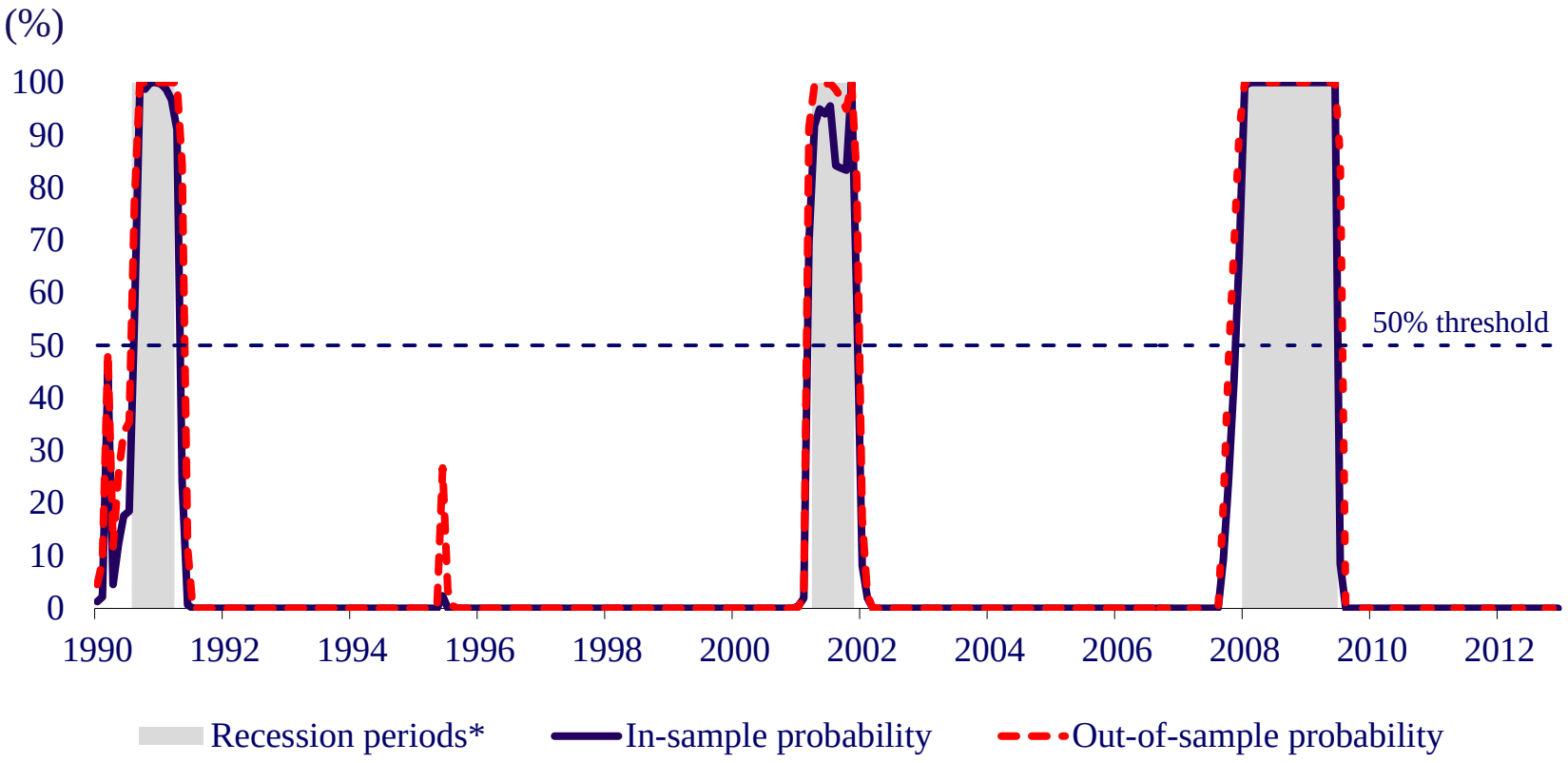


Source: The Forecasting Advisor.

1. In-sample probabilities from the one-month ahead probability model.

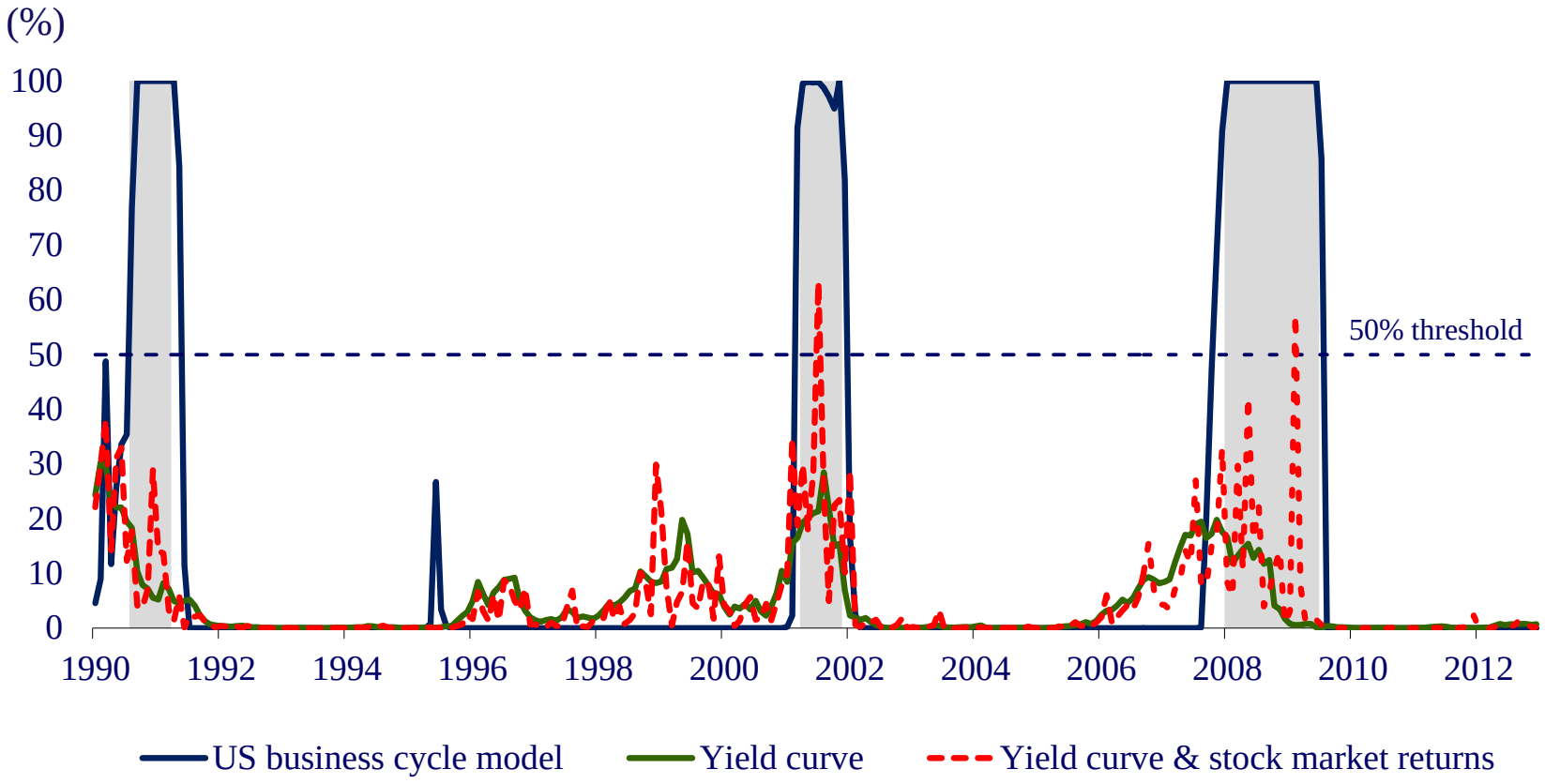
Out-of-Sample Forecasting Performance

Figure 10: Probability of the U.S. Being in a Recession: In- and Out-of-Sample Probabilities from January 1990 to December 2012[1]



Source: The Forecasting Advisor. 1. The out-of-sample probabilities are computed with coefficients of the model estimated from January1962 to December 1989. In-sample probabilities are computed from January 1962 to December 2012.
* The shaded areas correspond to recessions.

Figure 11: Probability of the U.S. Being in a Recession: Out-of-Sample Probabilities from Three Models[1]



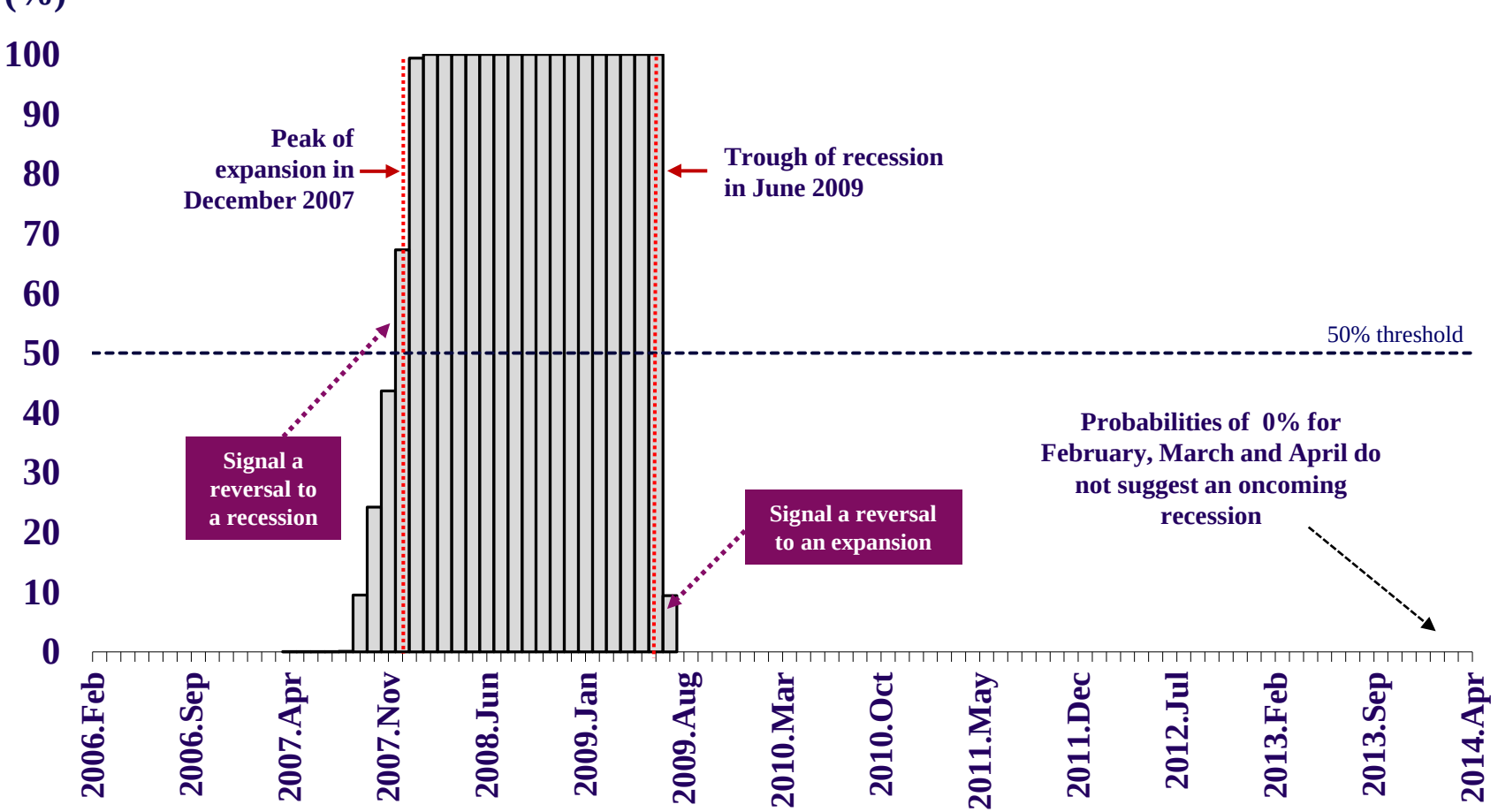
Source: The Forecasting Advisor. 1. The out-of-sample probabilities are computed with coefficients of the model estimated from January1962 to December 1989. In-sample probabilities are computed from January 1962 to December 2012.
* The shaded areas correspond to recessions.

Outlook on the Business Cycle in the U.S.

Model's Forecast	Phase of the Business Cycle			
	Actual	Outlook[1]		
	January 2014	February 2014	March 2014	April 2014
	Expansion			
Probability of Being in a Recession		0.0%	0.0%	0.0%
Predicted Outcome for the Business Cycle		Expansion to continue	Expansion to continue	Expansion to continue

1. The probabilities for February, March and April were computed on February 7, 2014.

Probability of the U.S. Being in a Recession



Source: The Forecasting Advisor.

Canadian Business Cycle Model

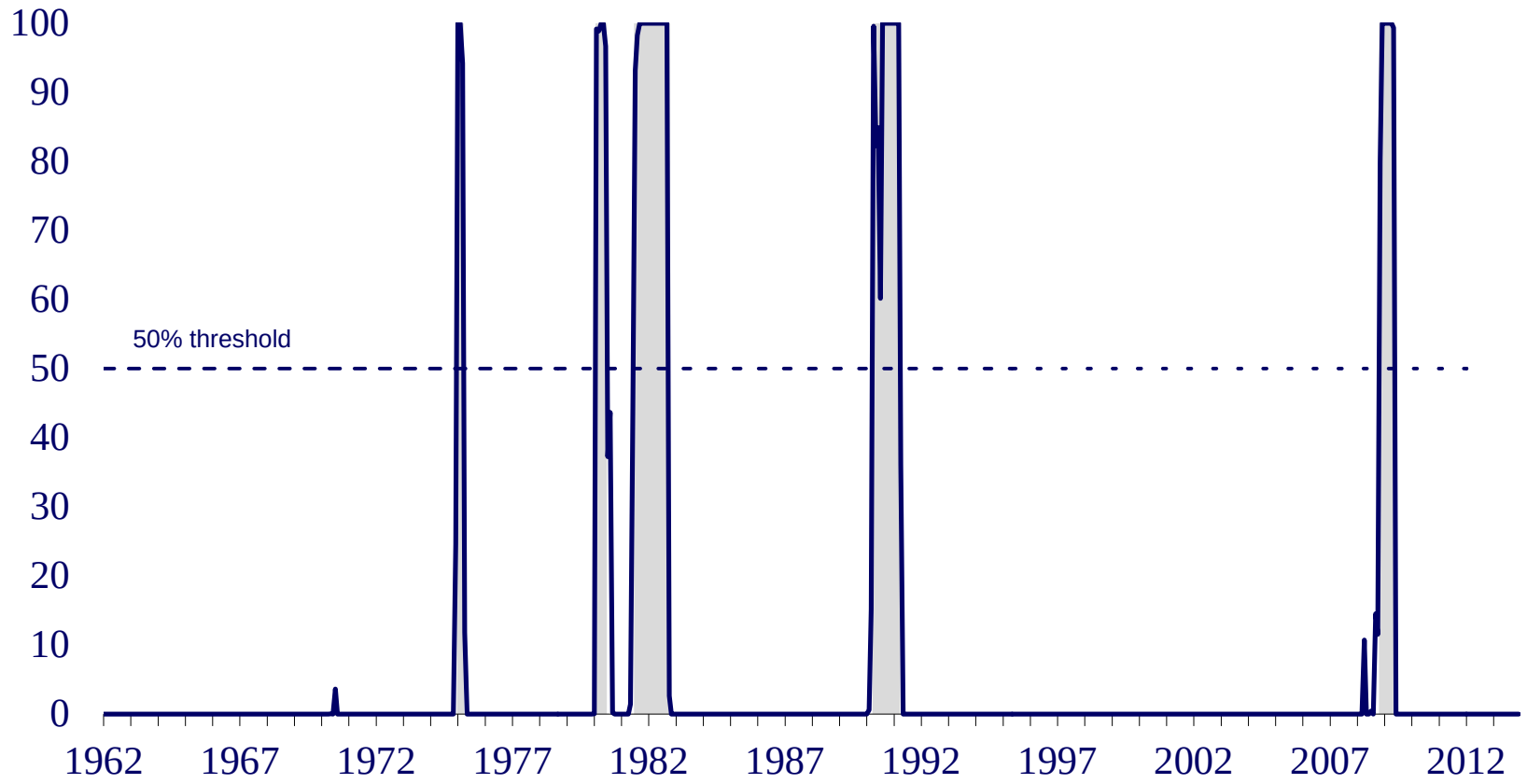
Model

- In the model, the Canadian business cycle is characterised by two phases: an expansion or a recession.
- The static probit modeling approach is used to calculate the probability of a reversal in the Canadian business cycle between expansion and recession phases. Lagged values of the state of the business cycle or (and) lagged values of the probability function is (are) not included in the model.
- The model includes a number of economic indicators for Canada, such as building permits, new orders, consumer confidence, and the yield curve.
- The probability is calculated for a forecast horizon of one to three months.
  - For example, on September 17, 2013, we calculated a probability for the months of August, September, and October.
- The predicted outcome for the state of the economy is determined using the usual 50% threshold:
  - When an expansion exists, the model predicts a reversal to a recession if the probability is equal or greater than 50%.[1] Otherwise, the model predicts that the expansion will continue.
  - When a recession exists, the model predicts a reversal to an expansion if the probability is equal or less than 50%.[1] Otherwise, the model predicts that the recession will continue.
- Figure 1 (next slide) illustrates the monthly evolution of the probability for Canada of being in a recession (identified by the blue line) along with the recession periods (grey shaded areas) since January 1962.

1. It is possible that one or very few explanatory variables of the model could explain the probability from rising from below to above 50%. In the future, when the model will give a signal of a reversal in the business cycle, the source of the change will be investigated in order to reduce as much as possible the risk of a making false signal.

Figure 1: Probability for Canada of Being in a Recession[1]: 1962-2012

(probability, %)



Source: The Forecasting Advisor. Last data point: December 2012. 1. One-month ahead probability.
* See Table 1 for the reference dates for the business cycle. The shaded areas correspond to the recessions.

Table 1
Forecasting the Reversals in the Business Cycle in Canada since 1962[1]

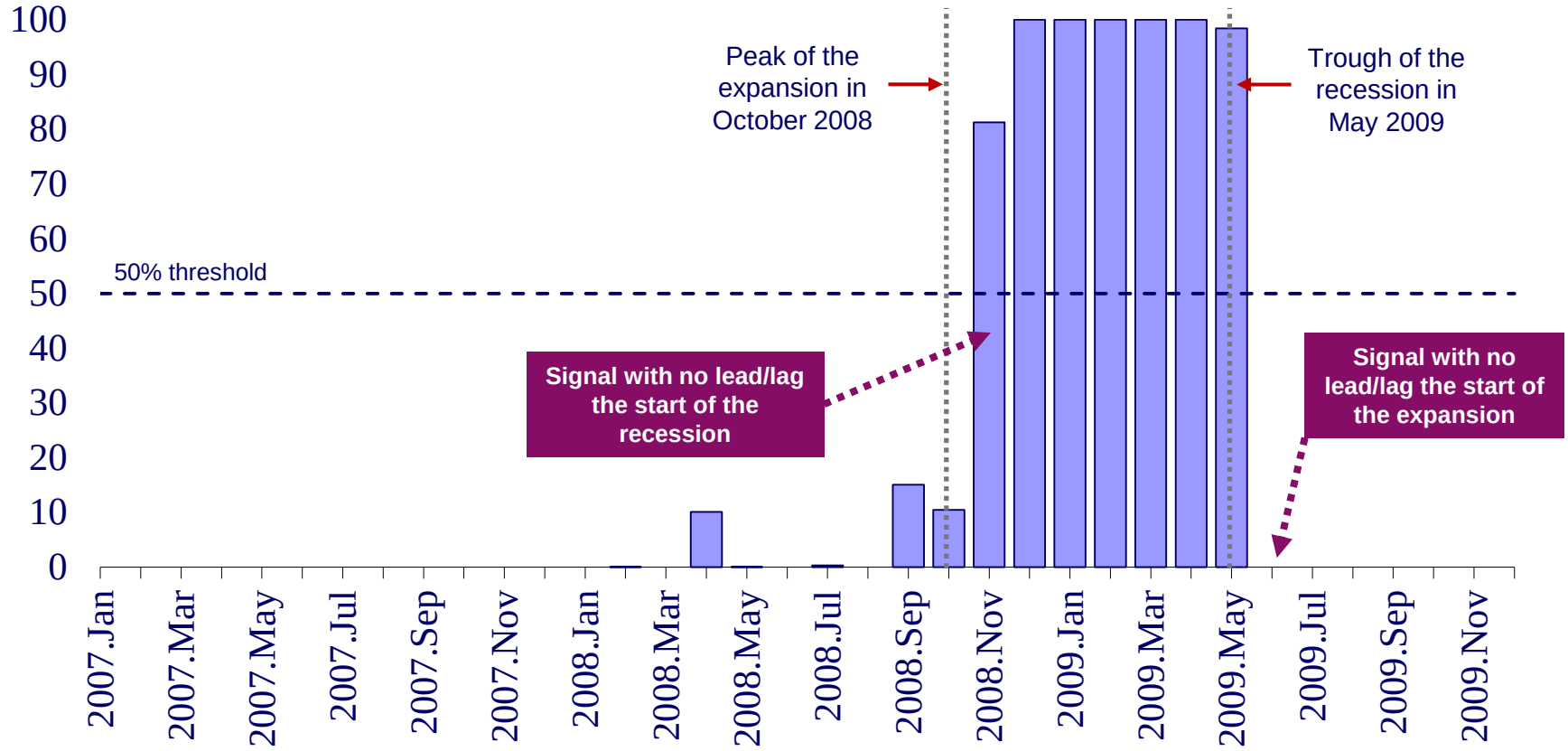
Business Cycle Reference Dates[2]		Lead (-) / Lag(+) in Predicting the Start of the Recession (in months)	Lead(-) / Lag(+) in Predicting the Start of the Expansion (in months)
Peak	Trough		
December 1974	March 1975	0	0
January 1980	June 1980	0	0
June 1981	October 1982	0	-1
March 1990	March 1991[3]	0	0
October 2008	May 2009	0	0
Average		0	-0.2

1. The results are based on the one-month ahead probability model.
2. The reference dates for the business cycle are from the C.D. Howe Institute (see Cross, P. and Bergevin, P., "Turning Points: Business Cycles in Canada since 1926", Commentary No. 366, October 2012.
3. We assumed that the 1990-1991 recession ended in March 1991 as quarterly real GDP began to recover in the second quarter of 1991, albeit at a modest pace, and total employment grew between the economic trough of March 1991 and most of the rest of 1991. Moreover, Cross (1996) stated that the recession ended in the first quarter of 1991.

In-Sample
Forecasting Performance

Figure 2: Probability for Canada of Being in a Recession : 2008-2009[1]

(probability, %)

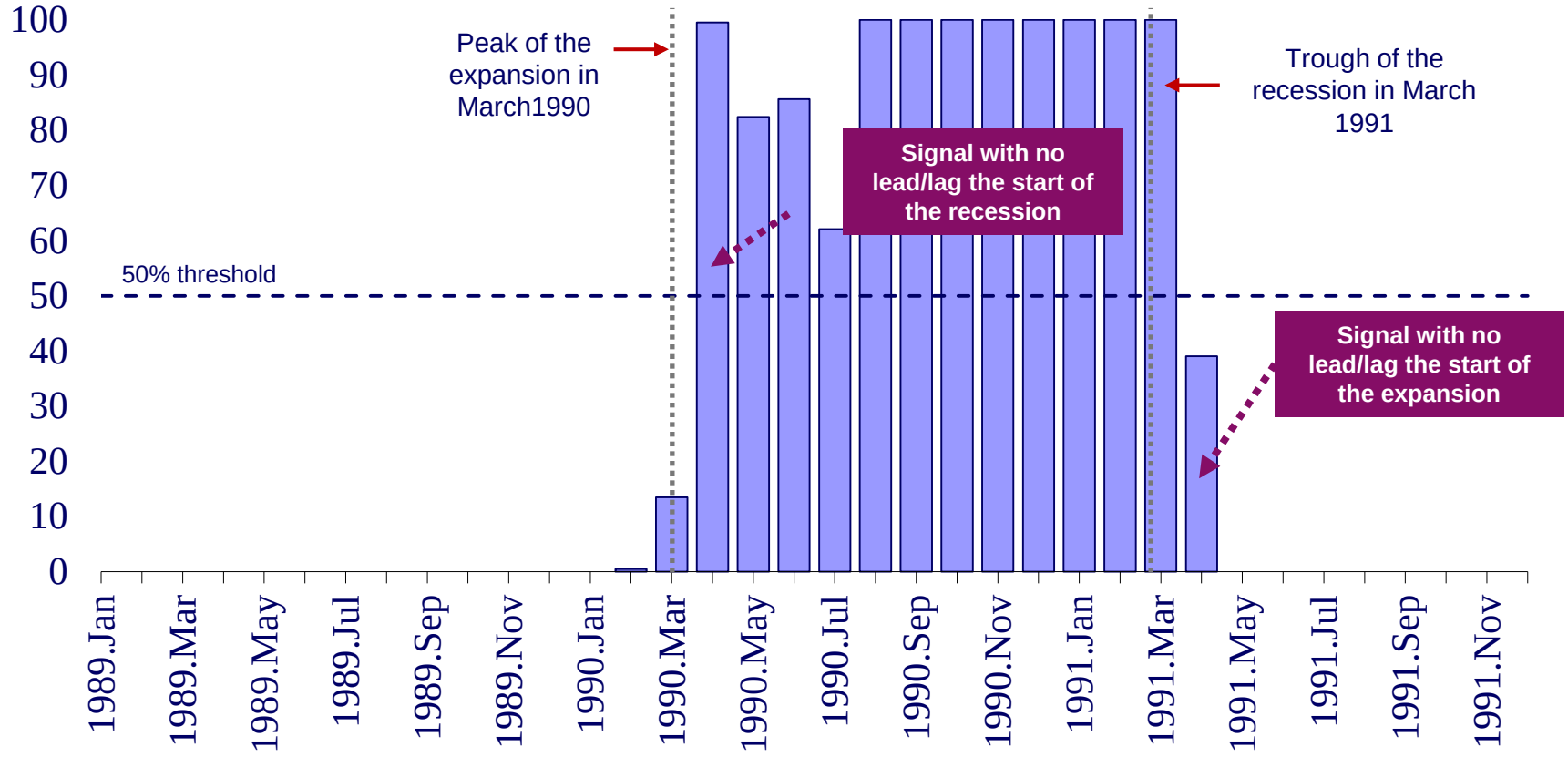


Source: The Forecasting Advisor.

1. One-month ahead probability.

Figure 3: Probability for Canada of Being in a Recession : 1990-1991[1]

(probability, %)

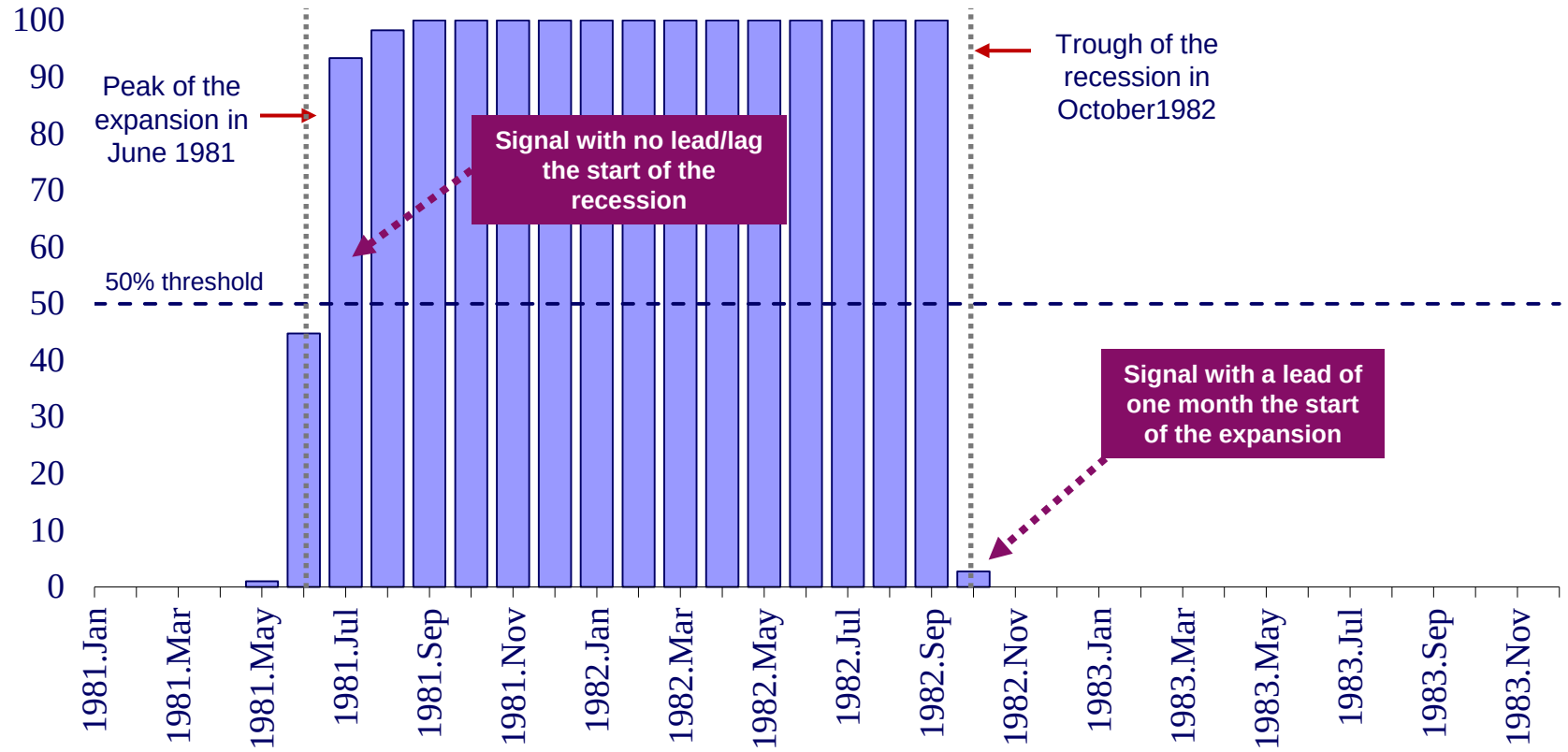


Source: The Forecasting Advisor.

1. One-month ahead probability.

Figure 4: Probability for Canada of Being in a Recession : 1981-1982[1]

(probability, %)

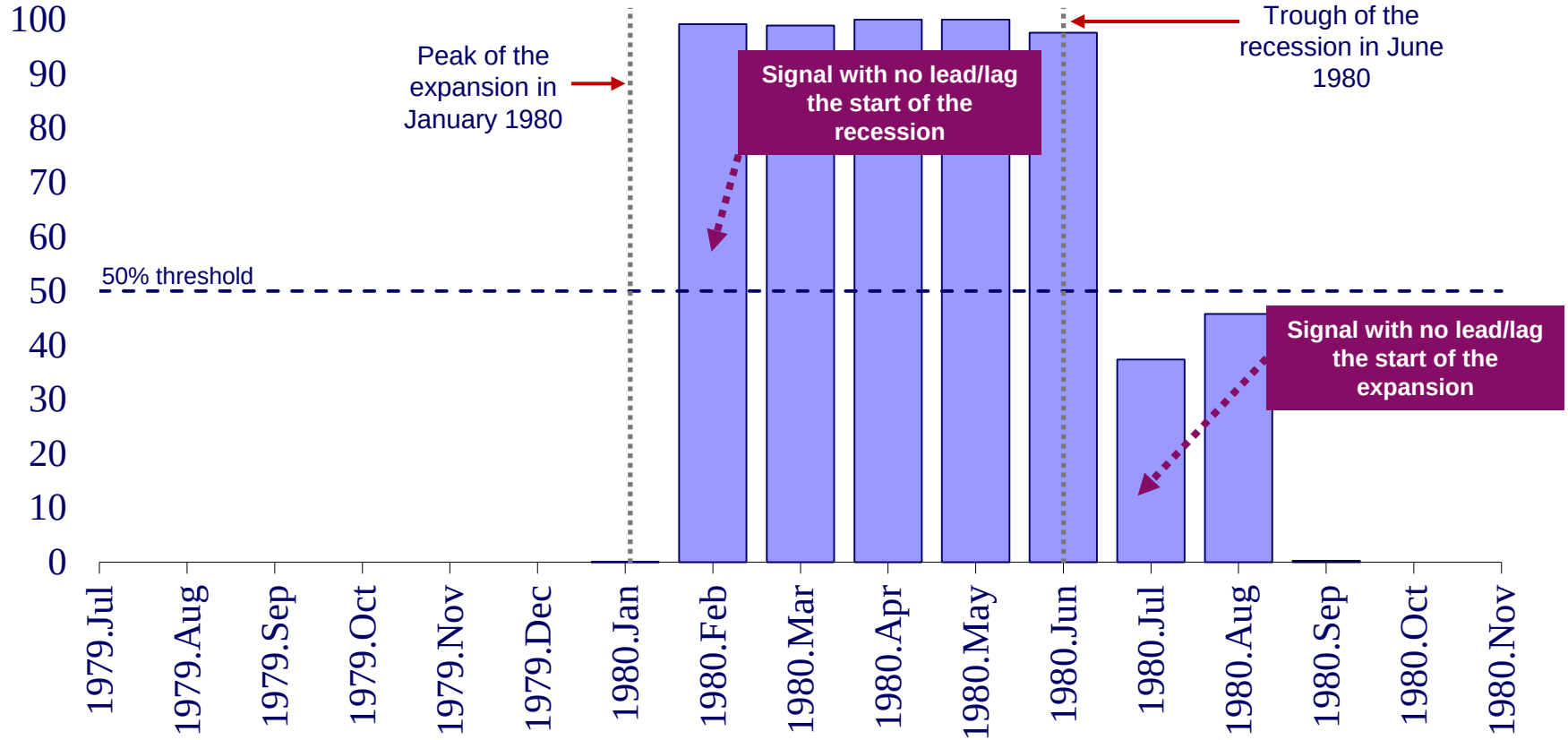


Source: The Forecasting Advisor.

1. One-month ahead probability.

Figure 5: Probability for Canada of Being in a Recession : 1980[1]

(probability, %)

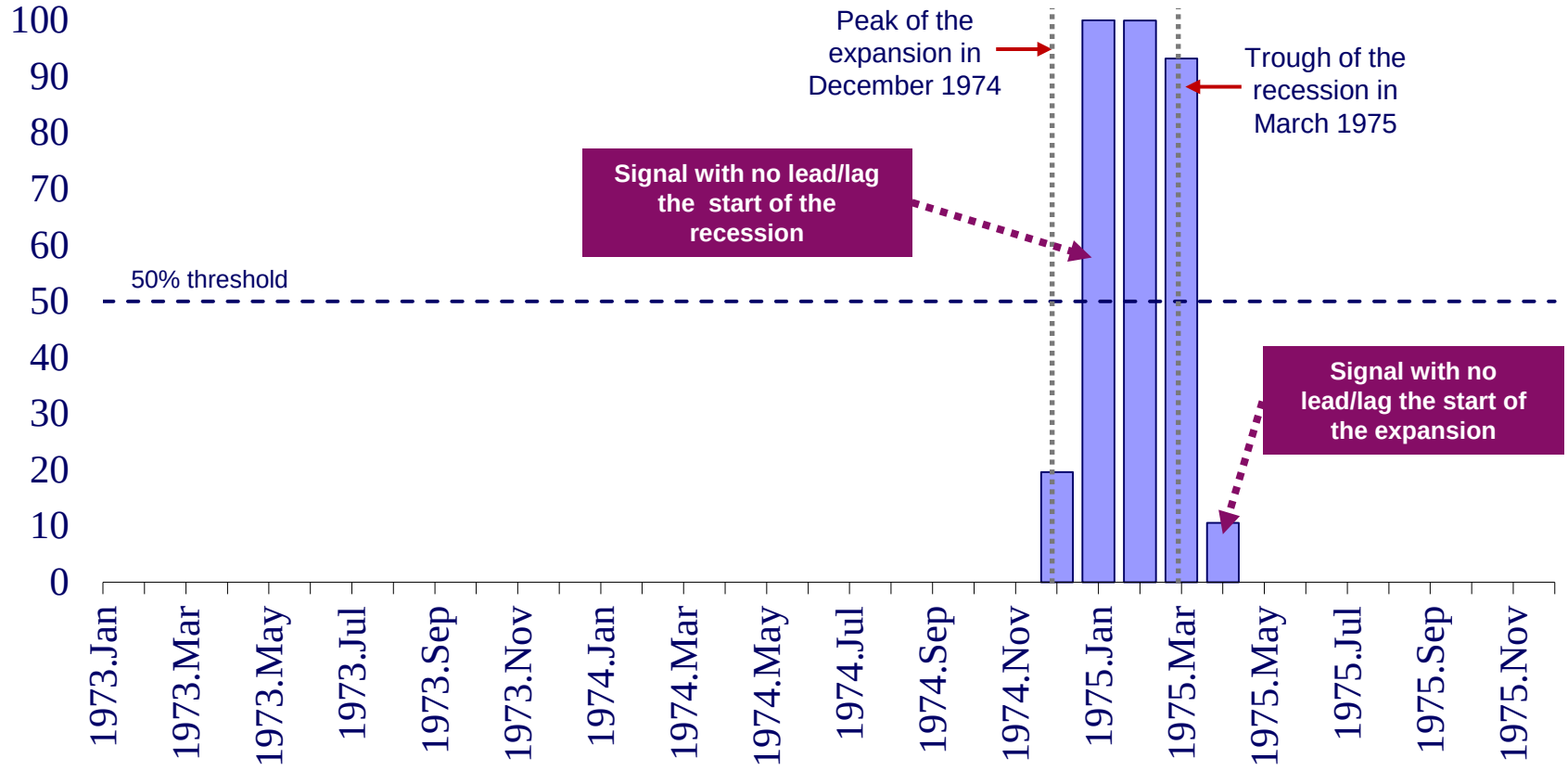


Source: The Forecasting Advisor.

1. One-month ahead probability.

Figure 6: Probability for Canada of Being in a Recession : 1975[1]

(probability, %)



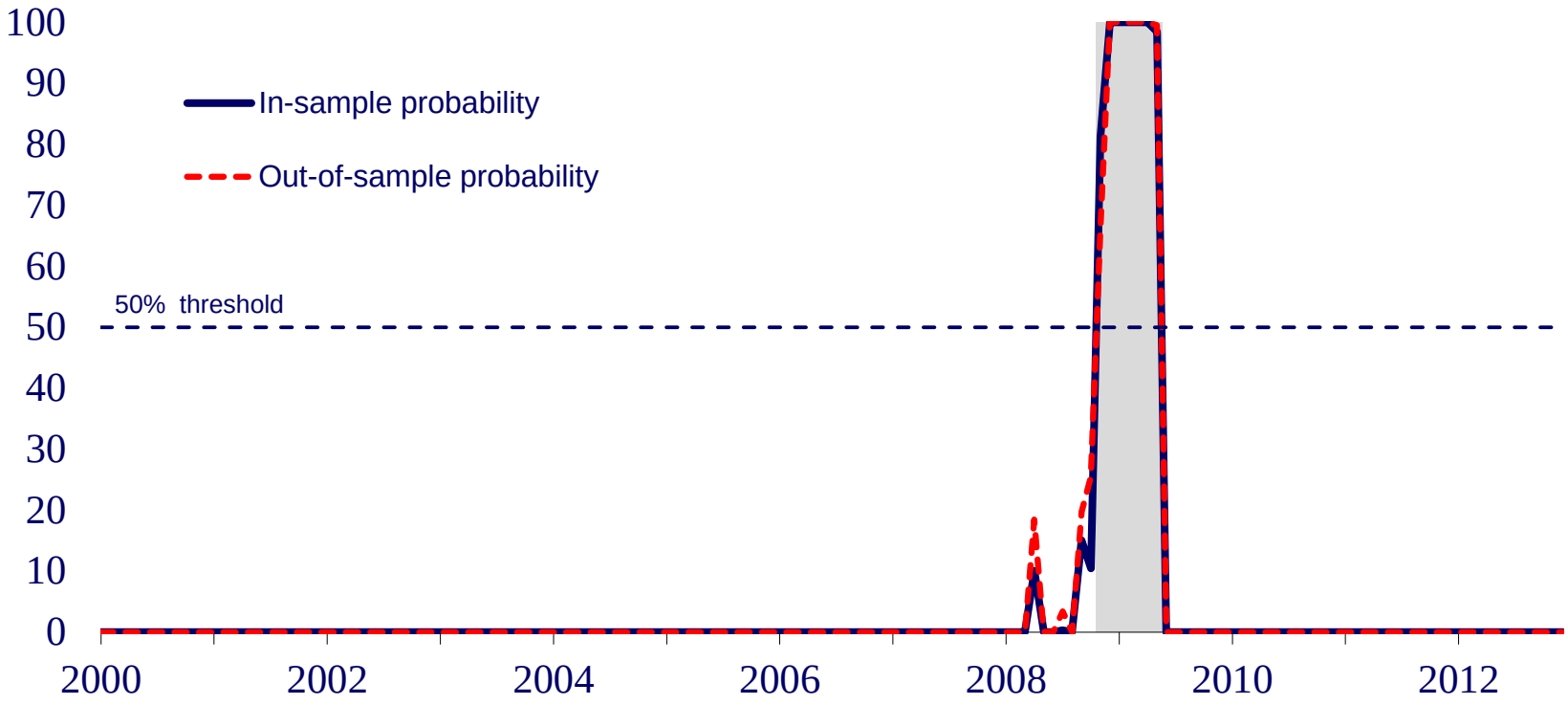
Source: The Forecasting Advisor.

1. One-month ahead probability.

Out-of-Sample Forecasting Performance

Figure 7: Probability for Canada of Being in a Recession: In- and Out-of-Sample Probabilities from January 2000 to December 2012[1]

(probability, %)



Source: The Forecasting Advisor.

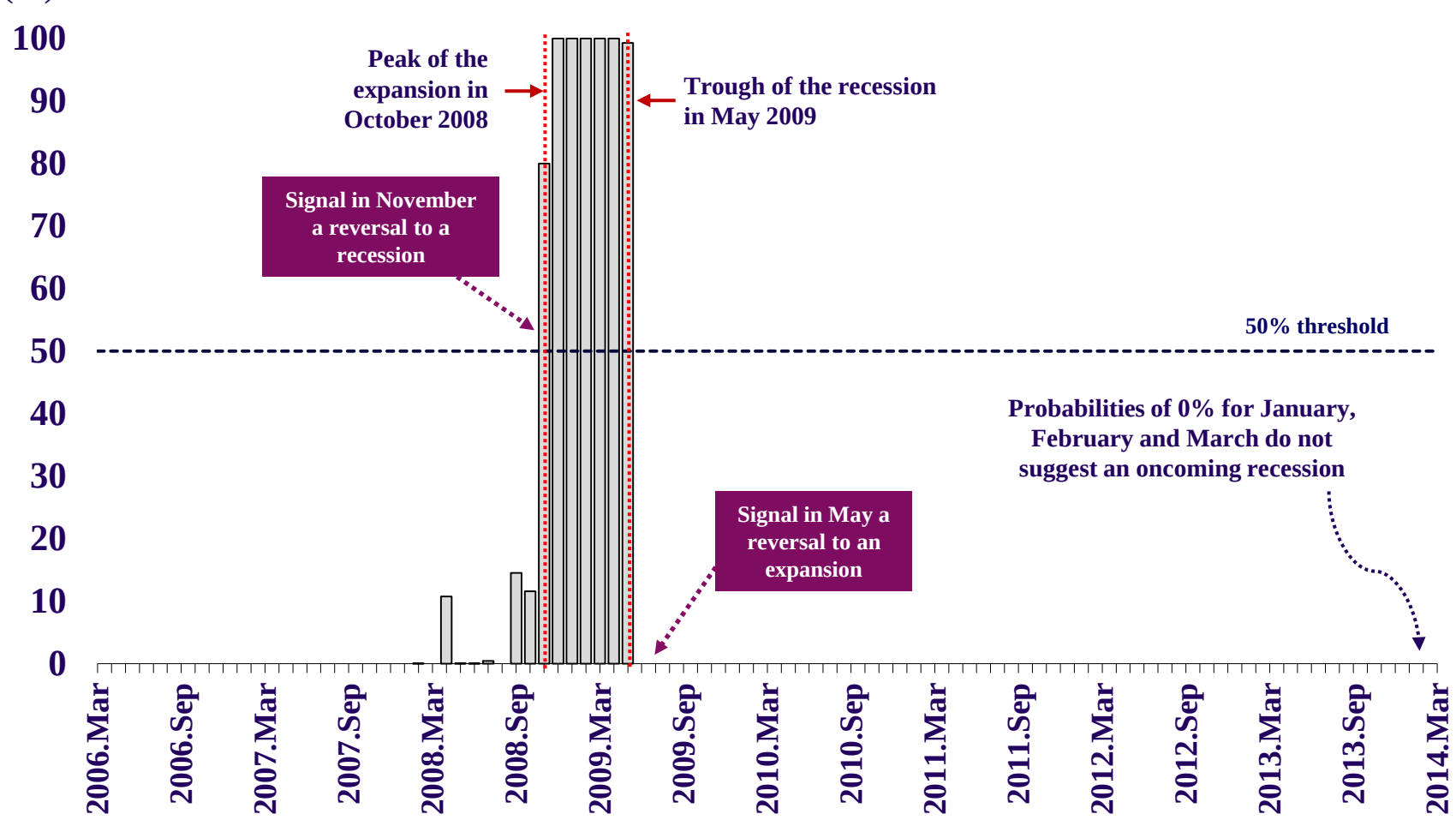
1. The out-of-sample probabilities are computed with coefficients of the model estimated from January1962 to December 1999. In-sample probabilities are computed from January 1962 to December 2012.

Outlook on the Business Cycle in Canada

Model's Forecast	Phase of the Business Cycle			
	Actual	Outlook[1]		
	December 2013	January 2014	February 2014	March 2014
	Expansion			
Probability of Being in a Recession		0.0%	0.0%	0.0%
Predicted Outcome for the Business Cycle		Expansion to continue	Expansion to continue	Expansion to continue

1. The probabilities for February, March and April were computed on February 14, 2014.

Probability for Canada Being in a Recession[1]



Source: The Forecasting Advisor.

U.S. Stock Market Cycle Model

Introduction

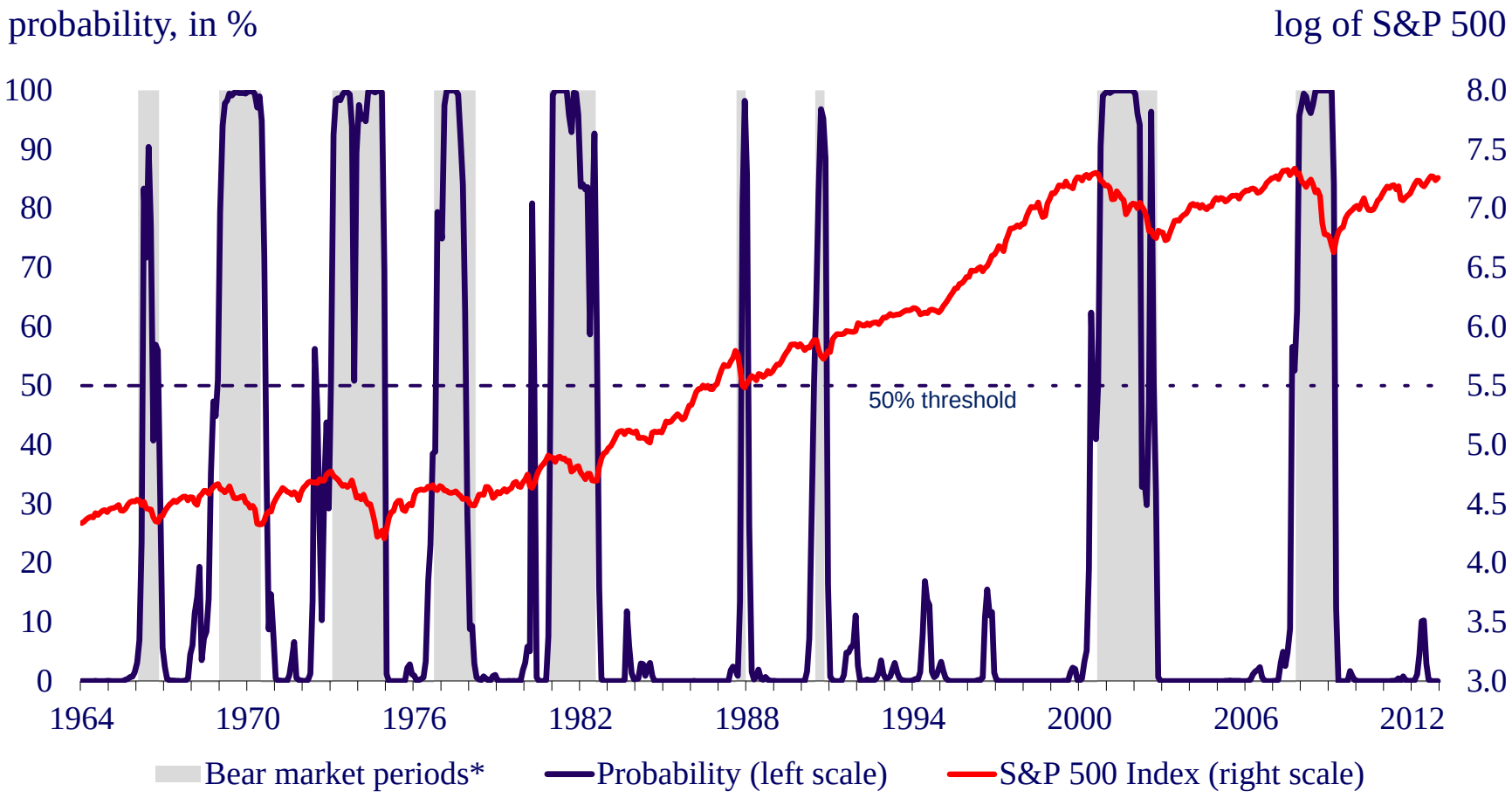
- In contrast to forecasting the business cycle, there is only two studies to the best of our knowledge that have looked at the issue of forecasting the state of the stock market cycle in the U.S.
- The first study is from Chen (2009) and he evaluated the information content of various economic indicators in forecasting U.S. bear markets. With a static probit model, he showed that the yield curve and the inflation rate are the best predictors. Other good predictors are the unemployment rate, short-term interest rates, and industrial production.
- The second study is from Nyberg (2013). His results showed that the state of the U.S. stock market cycle is predictable in- and out-of-sample, **but only** when the lagged values of the state of the stock market cycle or (and) lagged values of the probability function is (are) **included** in the model. In other words, the autoregressive and dynamic autoregressive probit models outperform a static probit model in forecasting U.S. bear and bull markets.

The model

- The U.S. stock market is benchmarked with the S&P 500 index and the stock market is characterised by two phases: a bull or a bear market.
- The traditional probit modeling approach is used to calculate the probability of a reversal in the stock market cycle between bear and bull phases. Lagged values of the state of the stock market cycle or (and) lagged values of the probability function is (are) not included in the model.
- The model, which is estimated with monthly data from January 1964, includes a number of U.S. economic indicators, such as production, the unemployment rate and the inflation rate.
- The predicted outcome for the U.S. stock market is determined using the usual 50% threshold:
  - When a bull market exists, the model predicts a reversal to a bear market if the probability is equal to or exceeds 50%.[1] Otherwise, the model predicts that the bull market will continue.
  - When a bear market exists, the model predicts a reversal to a bull market if the probability is equal to or falls below 50%.[1] Otherwise, the model predicts that the bear market will continue.
- Figure 1 (next slide) illustrates the monthly evolution of the probability of the S&P 500 index being in a bear market (blue line), the bear market periods (grey shaded areas) and the level of the S&P 500 (red line) since January 1964.

1. It is possible that an increase (decline) in the probability to above (below) 50% could be explained by a limited number of the model's explanatory variables. In the future, when the model signals a reversal in the state of the stock market cycle, the source of the change in the probability will be investigated in order to reduce the risk of a false alarm.

Figure 1: Probability of the S&P 500 Index Being in a Bear Market[1]: 1964-2012



Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).
1. In-sample probabilities from the one-month ahead regression probit model.
* See Table 1 for reference dates for the stock market cycle.

Table 1
Some Key Probit Estimation Output for the U.S. Stock Market Cycle Model [1]

Model	McFadden R-square	
U.S. Stock Market Cycle Model	0.79	
Alternative probit models: Chen (2009) Nyberg (2013)	 0.006 to 0.103[2] 0.041, 0.135, 0.412[3], 0.807[3]	
Prediction Evaluation **(Success rate based on the 50% rule)**	**In-Sample[4]**	**Out-of-Sample[5]**
Predicted / Total Bear Market Months	126 / 139 (91%)	35 / 43 (81%)
Predicted / Total Bull Market Months	446 / 456 (98%)	82 / 89 (92%)

1. The results are from the one-month ahead probability model.
2. Based on the static probit model approach.
3. The last two values comes from an autoregressive and a dynamic/autoregressive probit model.
4. Based on an estimation period of January 1962 to July 2013.
5. Based on an estimation period of January 1962 to December 1999. Out-of-sample from January 2000 to December 2010.

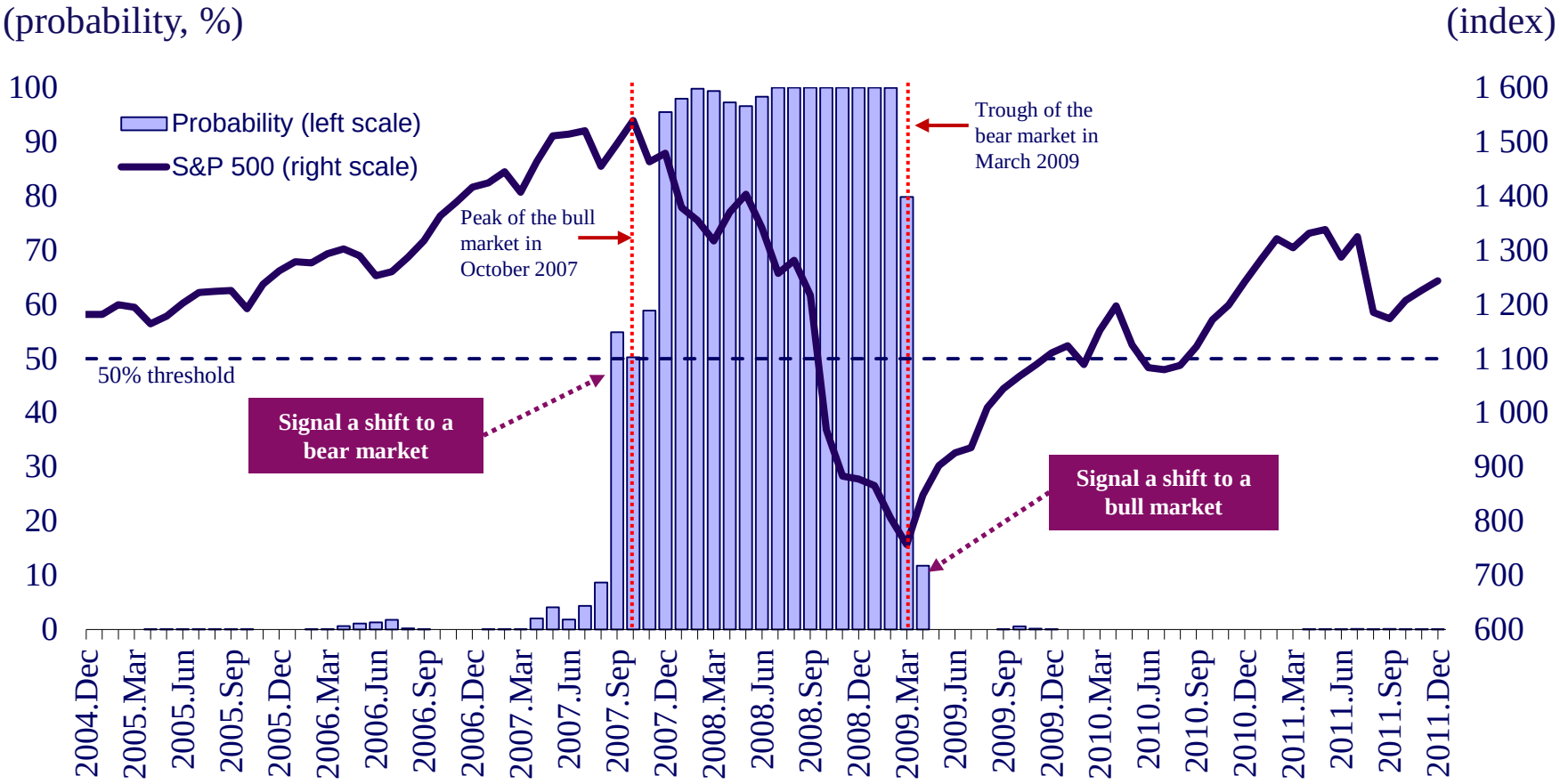
Table 2
Performance of the Model in Forecasting the Reversals to Bear and Bull Markets in the S&P 500 Index since 1966

Actual start of the bear market[1]	Signal of a shift to a bear market[2]	# of months before (-) or after (+) the actual start of a bear market	Actual start of the bull market[1]	Signal of a shift to a bull market[2]	# of months before (-) or after (+) the actual start of a bull market
Feb. 1966	Apr. 1966	+2	Nov. 1966	Nov. 1966	0
Jan. 1969	Dec. 1968	-1	Jul. 1970	Sep. 1970	+2
Feb. 1973	Oct. 1972	-4	Jan. 1975	Jan. 1975	0
Oct. 1976	Sep. 1976	-1	Apr. 1978	Dec. 1977	-4
Dec. 1980	Dec. 1980	0	Aug. 1982	May 1982	-3
Sep. 1987	Nov. 1987	+2	Jan. 1988	Feb. 1988	+1
Jul. 1990	Jul. 1990	0	Nov. 1990	Dec. 1990	+1
Sep. 2000	Jul. 2000	-2	Nov. 2002	Jun. 2002	-5
Nov. 2007	Sep. 2007	-2	Apr. 2009	Apr. 2009	0
Average		-0.7	Average		-0.9

1. There are no official reference dates for the start and the end of bear markets for the S&P 500 price index. A bear market is generally defined as a decline of about 20% or more spread in a broad market index over a period of at least two months (see Tables 2 and 3 at the end of the document for the duration and percentage change in all the bear and bull markets since 1966). The dates reported in Table 1 correspond to those available in the economic literature.
2. The signals were determined using the usual 50% threshold.

In-Sample Forecasting Performance

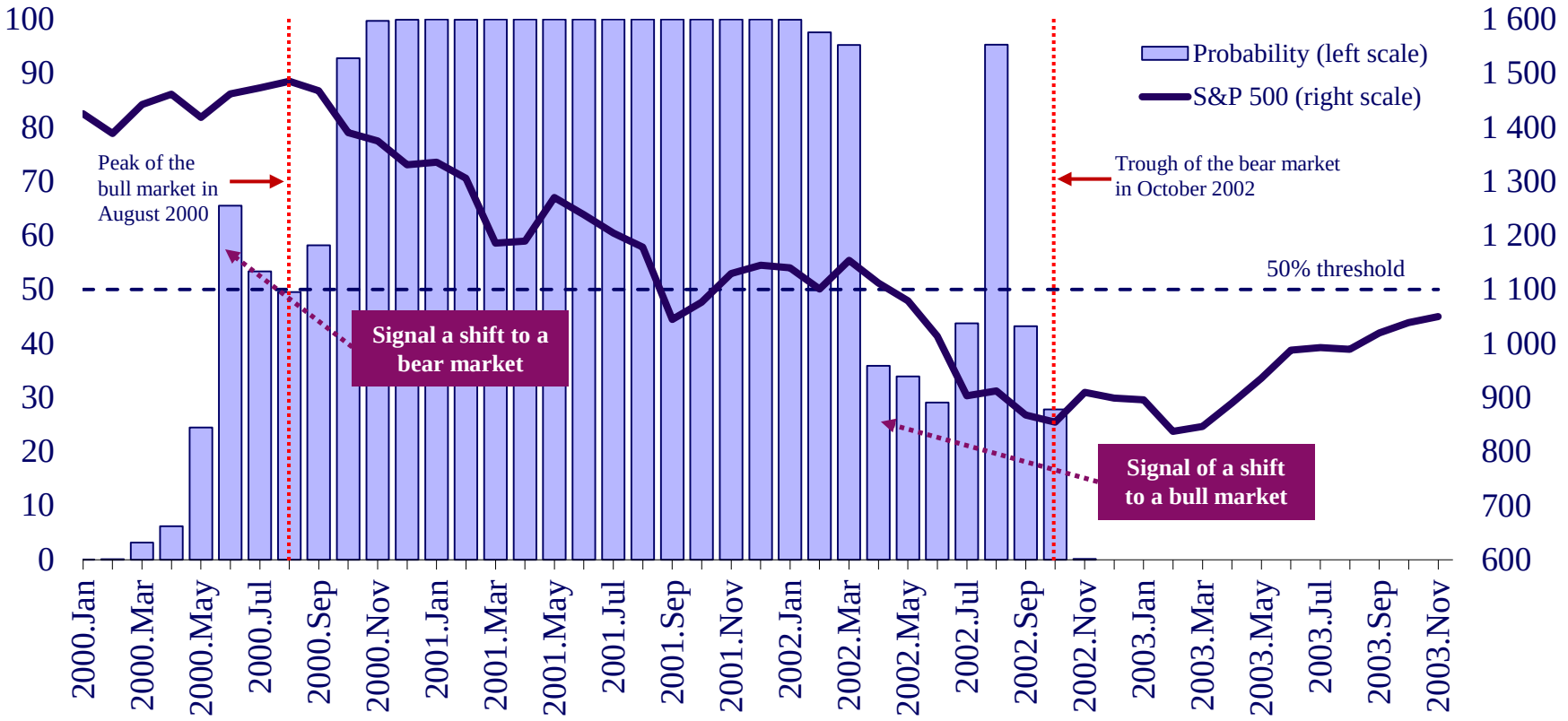
Figure 2: Probability of the S&P 500 Index Being in a Bear Market,[1] 2007-2009



Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).
1. In-sample probabilities from the one-month ahead probability model.

Figure 3: Probability of the S&P 500 Index Being in a Bear Market,[1] 2000-2002

(probability, %) (index)

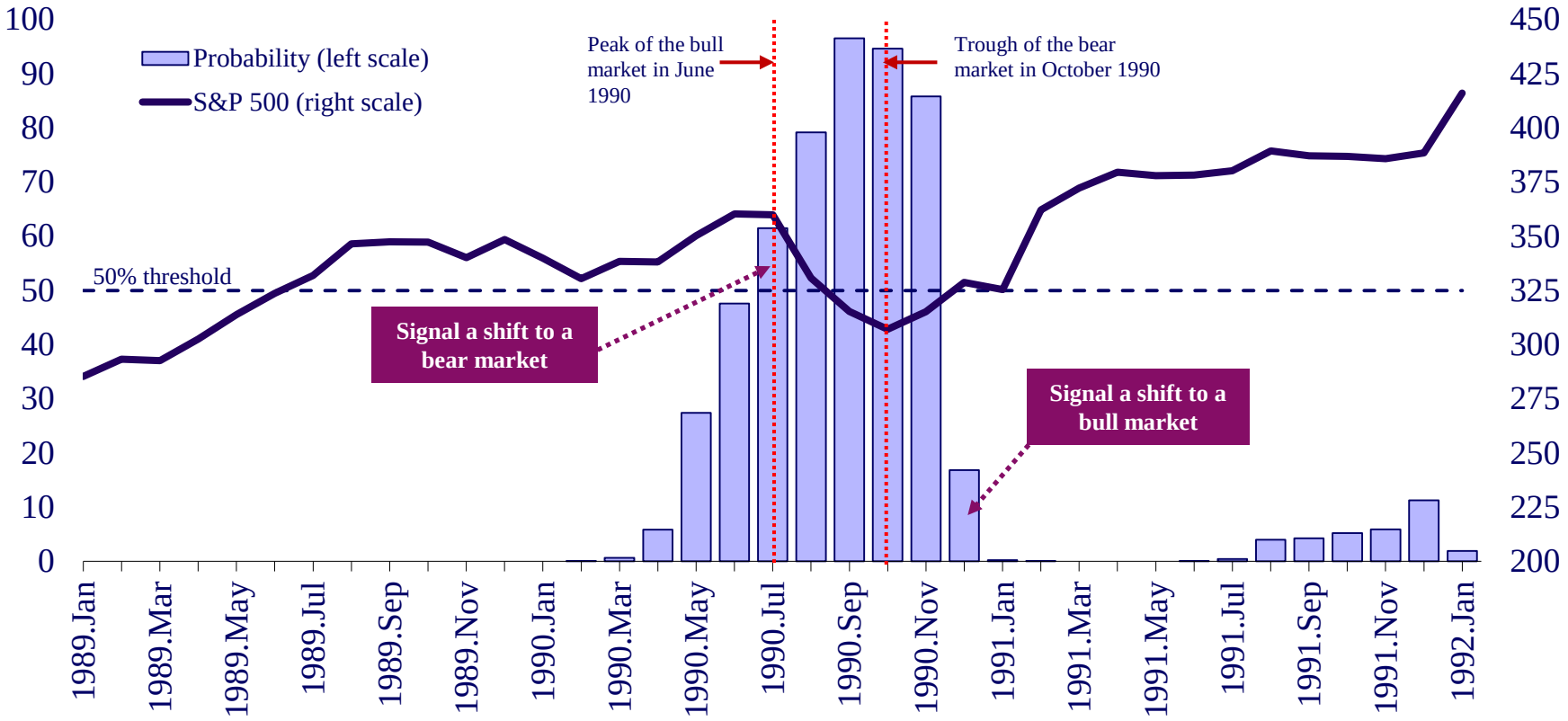


Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).

1. In-sample probabilities from the one-month ahead probability model.

Figure 4: Probability of the S&P 500 Index Being in a Bear Market,[1] 1990

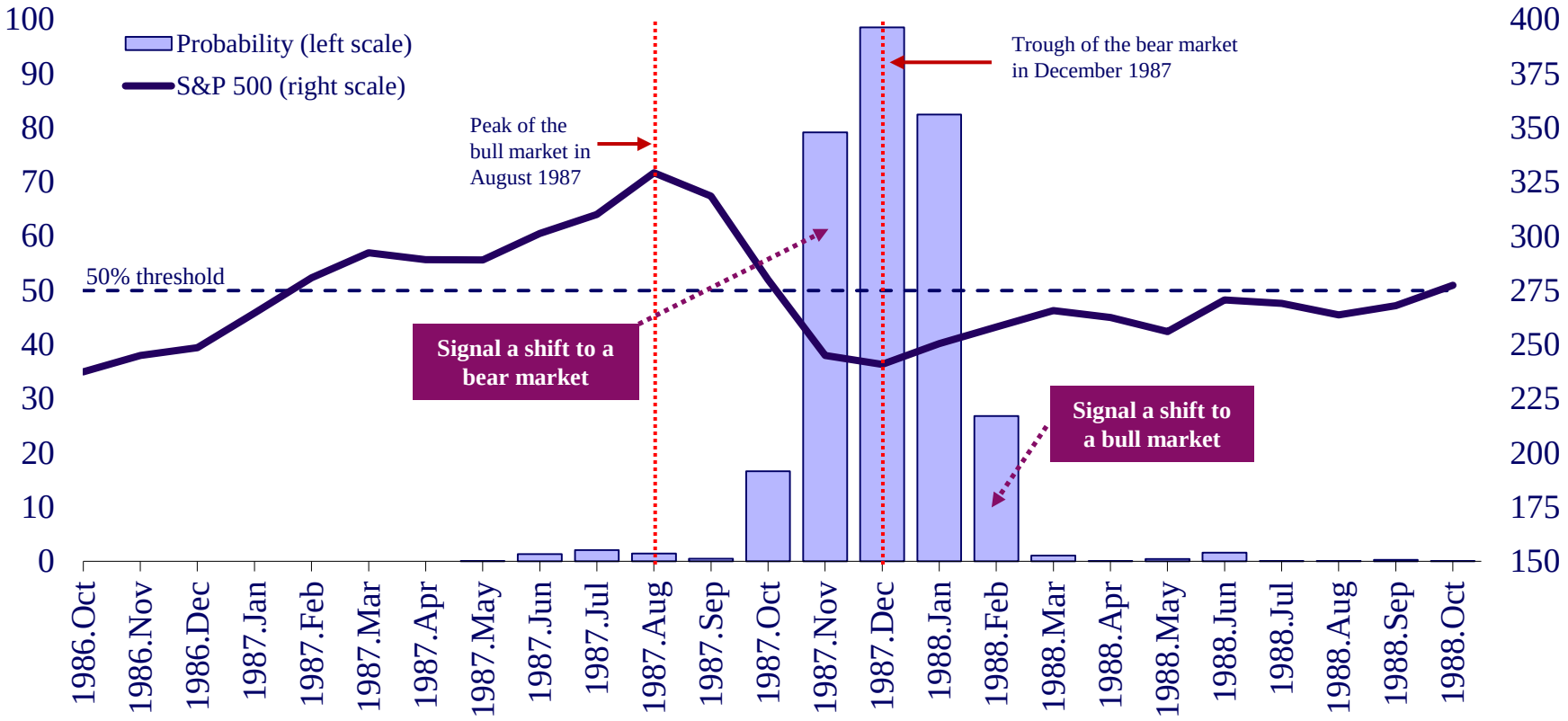
(probability, %) (index)



Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).
1 In-sample probabilities from the one-month ahead probability model.

Figure 5: Probability of the S&P 500 Index Being in a Bear Market,[1] 1987

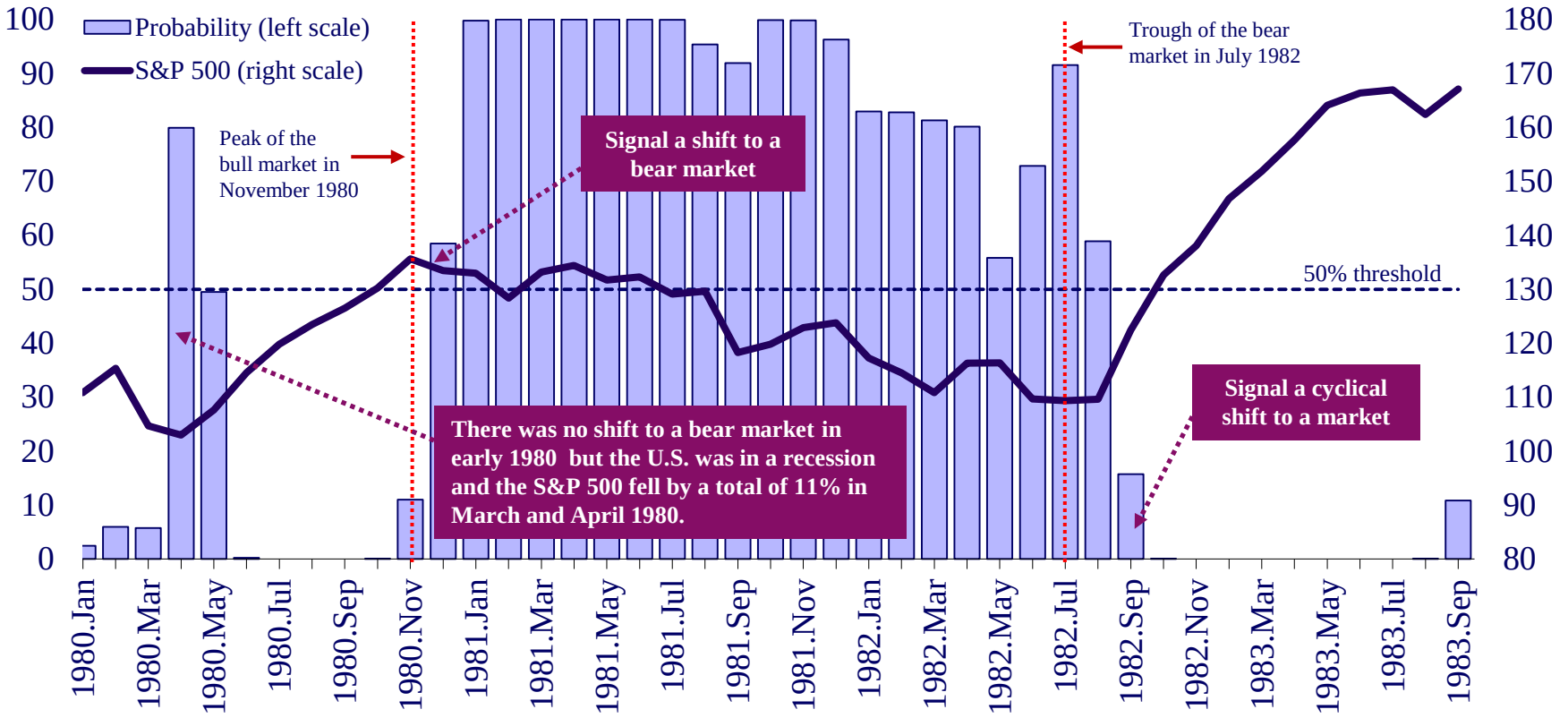
(probability, %) (index)



Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).
1. In-sample probabilities from the one-month ahead probability model.

Figure 6: Probability of the S&P 500 Index Being in a Bear Market,[1] 1980-1982

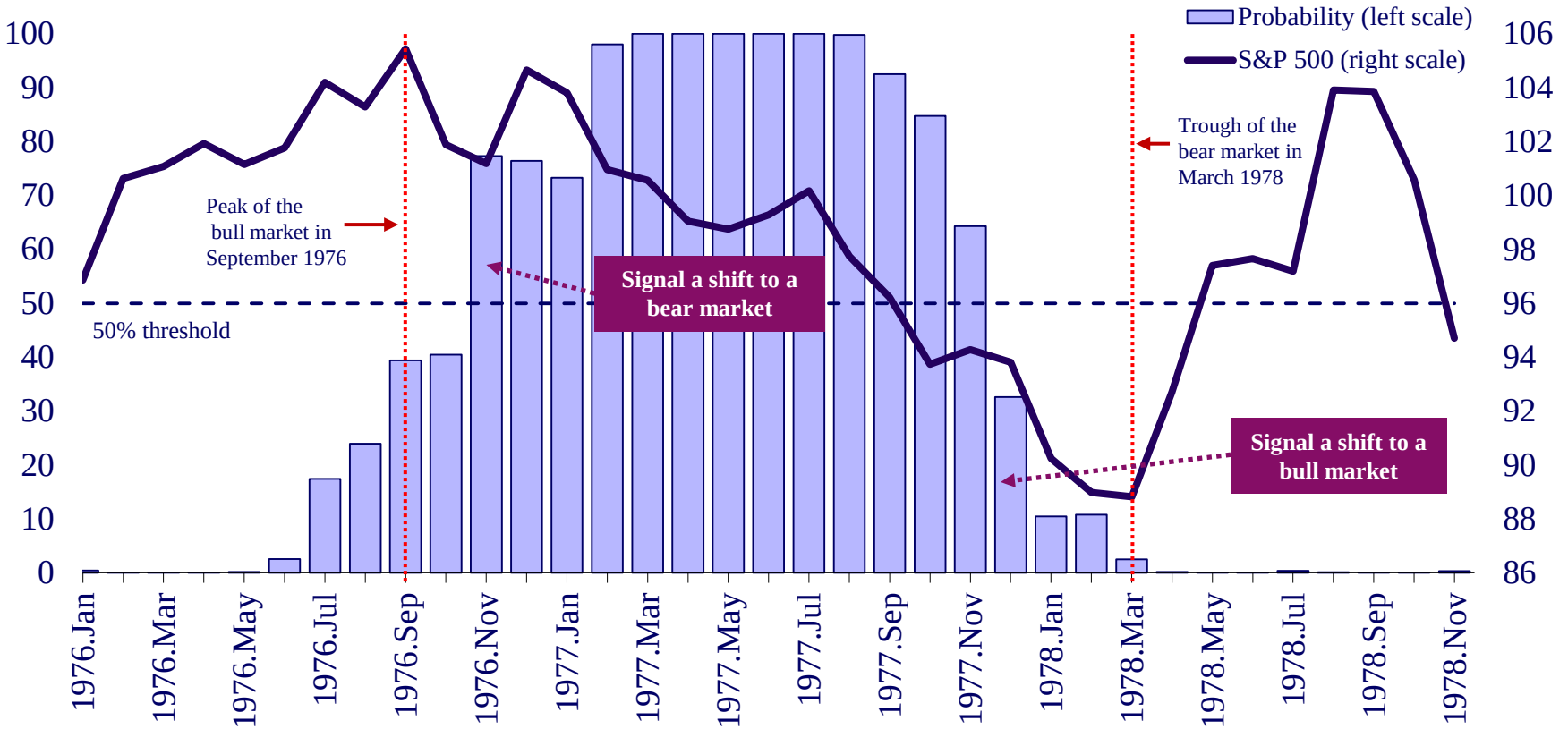
(probability, %) (index)



Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).

1. In-sample probabilities from the one-month ahead probability model.

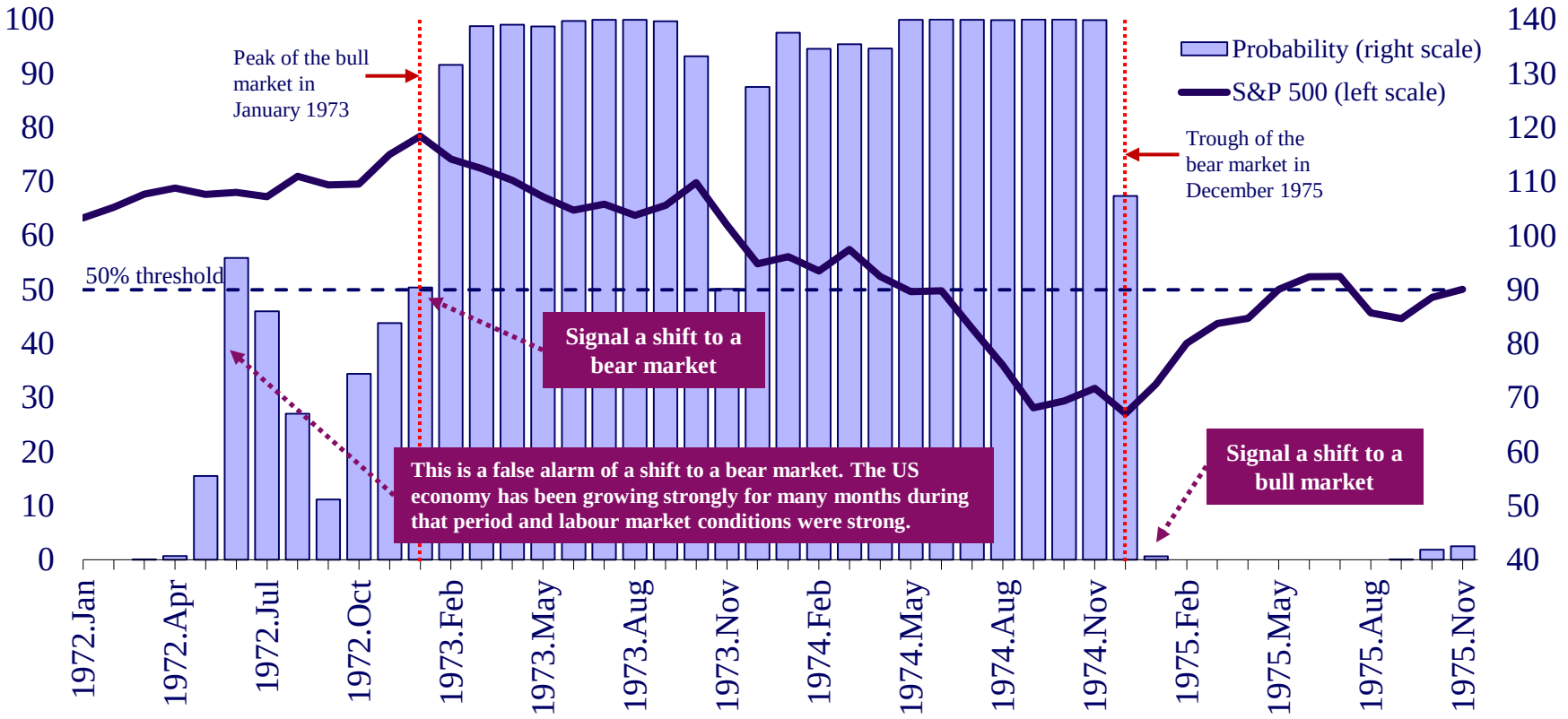
Figure 7: Probability of the S&P 500 Index Being in a Bear Market,[1] 1976-1978



Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).
1. In-sample probabilities from the one-month ahead probability model.

Figure 8: Probability of the S&P 500 Index Being in a Bear Market,[1] 1973-1975

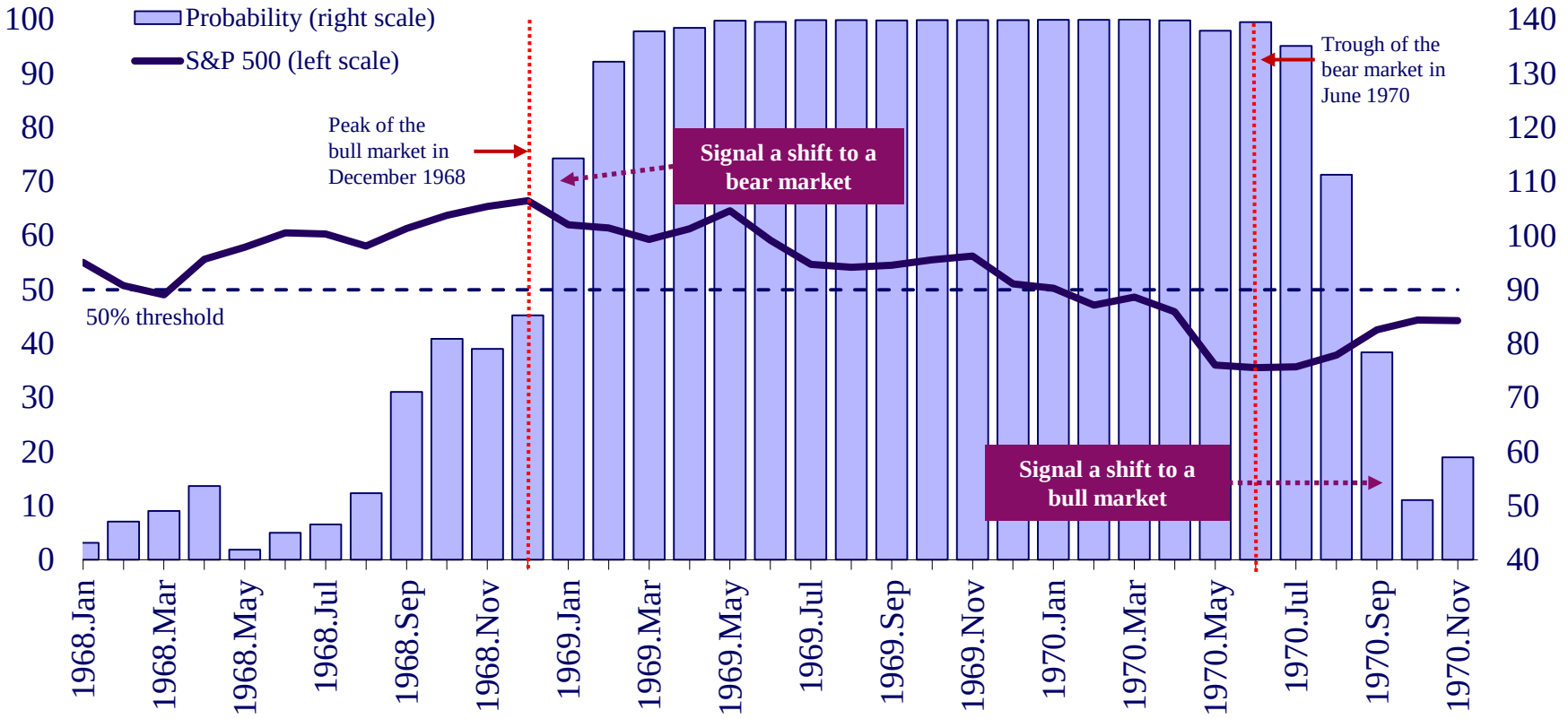
(probability, %) (index)



Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).
1. In-sample probabilities from the one-month ahead probability model.

Figure 9: Probability of the S&P 500 Index Being in a Bear Market,[1] 1969-1970

(probability, %) (index)

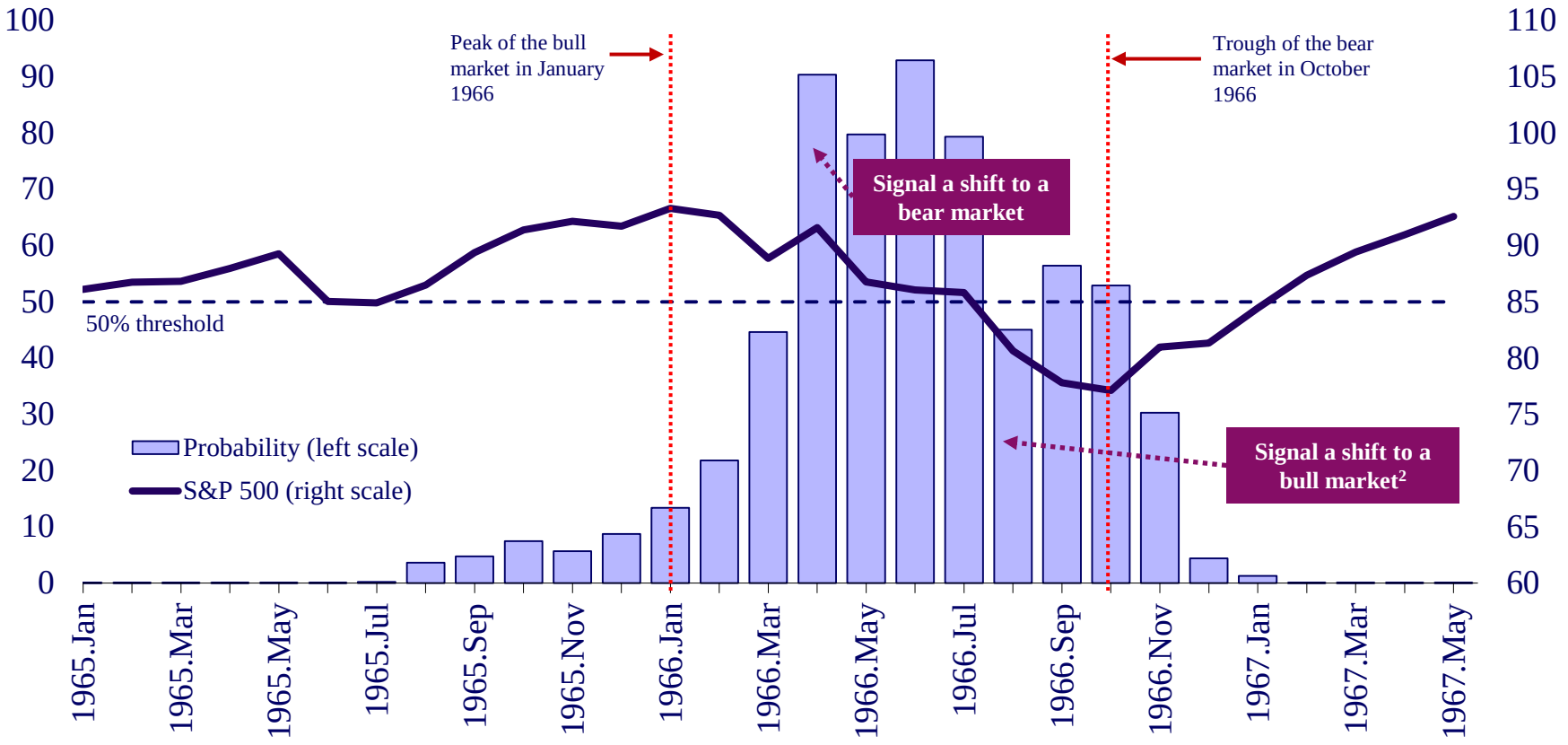


Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).

1. In-sample probabilities from the one-month ahead probability model.

Figure 10: Probability of the S&P 500 Index Being in a Bear Market,[1] 1966

(probability, %) (index)

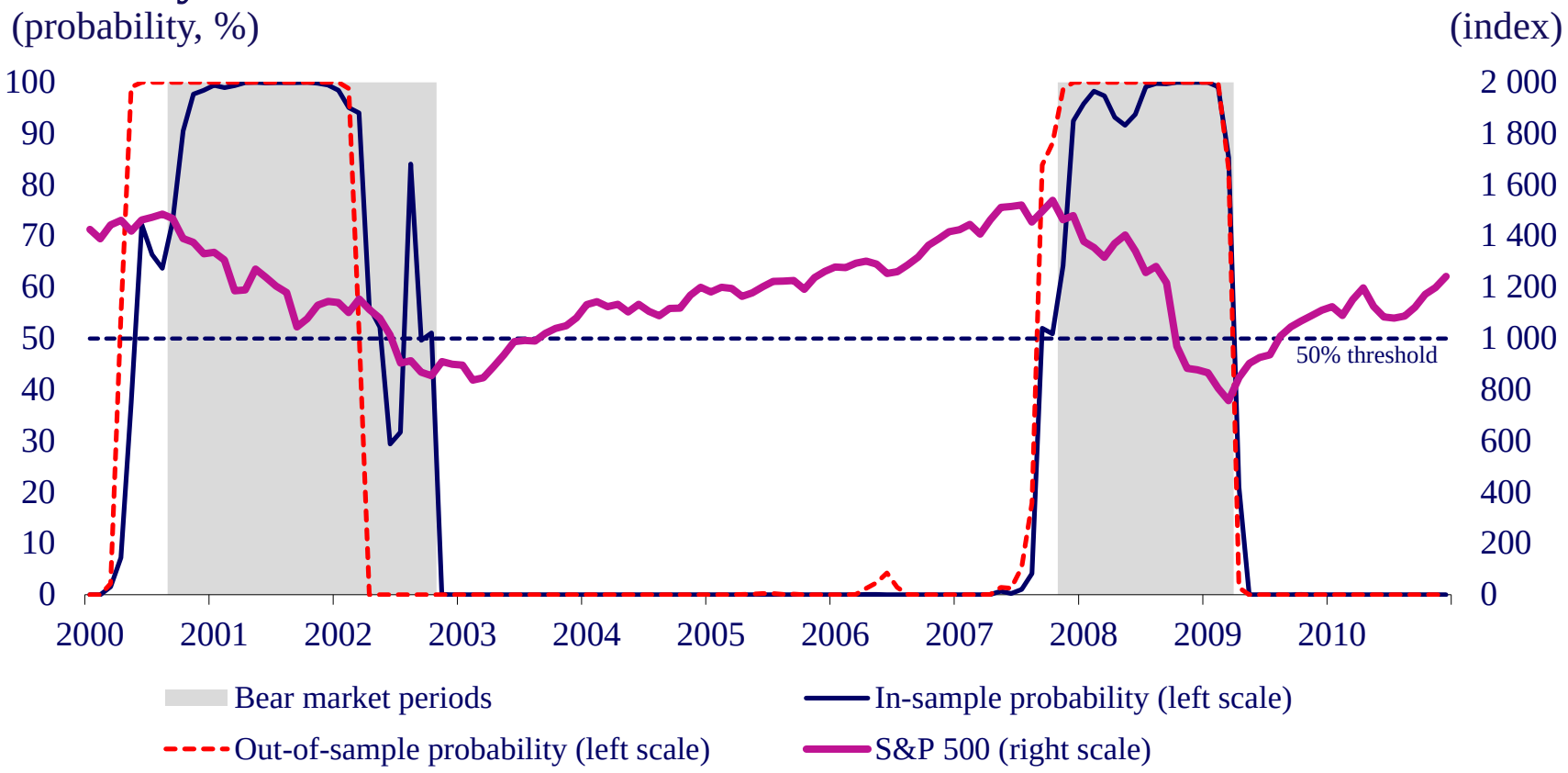


Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability).

1. In-sample probabilities from the one-month ahead probability model.

Out-of-Sample Forecasting Performance

Figure 11: Probability of the S&P 500 Index Being in a Bear Market[1]: In- and Out-of-Sample Probabilities from January 2000 to December 2010[2]



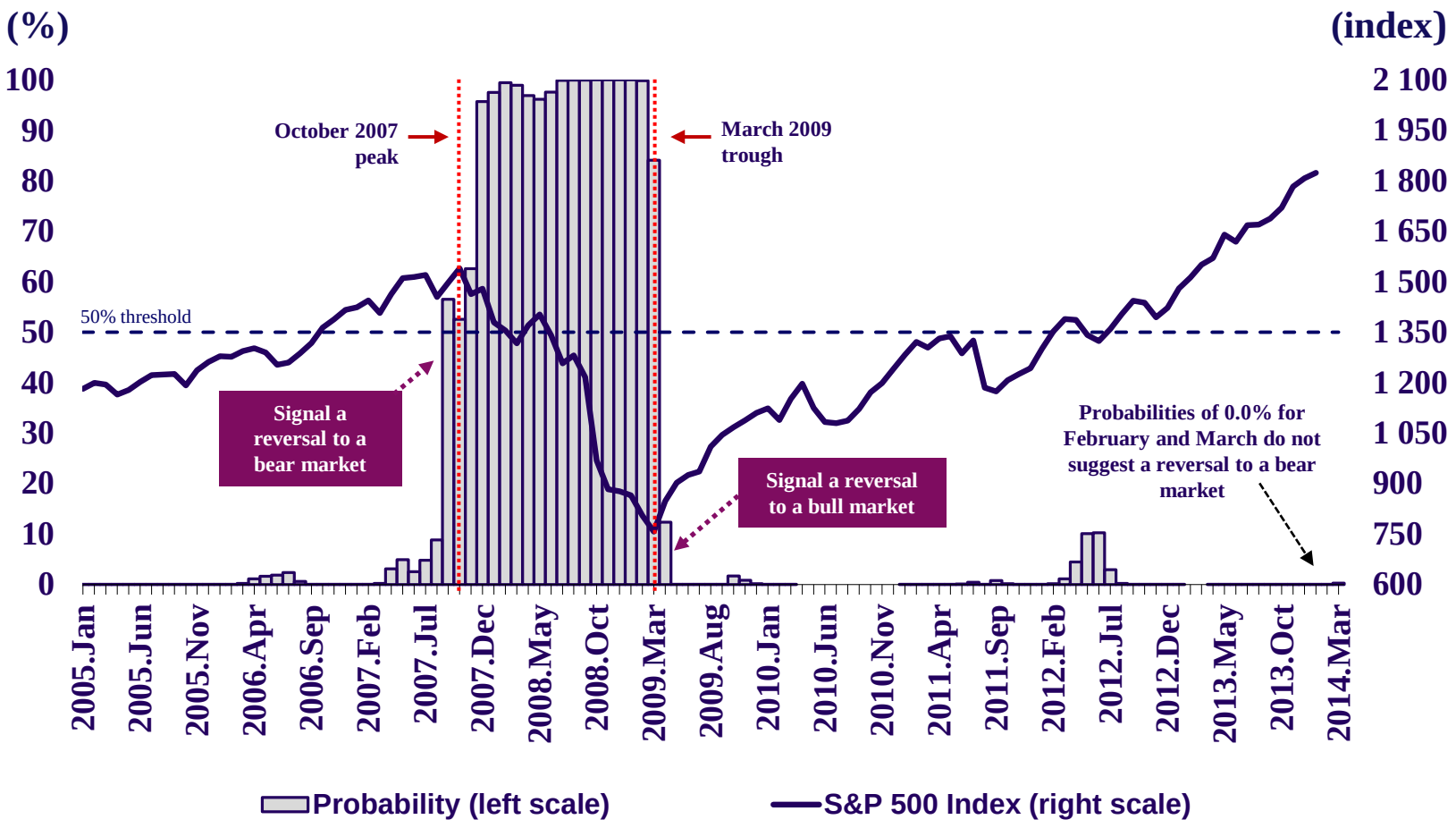
Sources: Federal Reserve Bank of St-Louis Fred Database (S&P 500 index) and The Forecasting Advisor (probability). 1. One-month ahead probability. 2. The out-of-sample probabilities were computed with coefficients estimated from January 1964 to December 1999 and the in-sample probabilities with coefficients estimated from January 1964 to December 2012.

Outlook on the Stock Market Cycle in the U.S.

Model's Forecast	State of the Stock Market		
	Actual	Outlook[1]	
	January 2014	February 2014	March 2014
	Bull market		
Probability of Being in a Bear Market		0.0%	0.3%
Predicted Outcome for the Stock Market		Bull market will continue	Bull market will continue

1. The probabilities were computed on February 7, 2014.

Probability of the S&P 500 Index Being in a Bear Market[1]



Source: The Forecasting Advisor.

Forecasting Canadian Real GDP and Employment by Industry

Robert Lamy
The Forecasting Advisor
www.theforecastingadvisor.com

Forecasting Real GDP by Industry in Canada

Description

- The general form of the GDP equation by industry is presented below:

$$GDP^{i}_{t} = f(D_{t-i}, EXR_{t}, V_{t}, GDP^{i}_{t-1})$$

where

- GDP^{i} is the value of real gross domestic product (GDP) for the industry *i*
- D is a vector of long-term determinants of real GDP in the industry *i*, such as foreign/domestic economic activity.
- EXR is the Canada-US real exchange rate
- V is a vector of short-term determinants of real GDP for the industry *i*, such as the rate of growth in foreign/domestic economic activity
- GDP^{i} is the value of real GDP for the industry *i* at time *t-1*

- For the goods-producing sector, there is an equation for each of the following industry:
  - Agriculture, forestry, fishing, and trapping (NAICS 11); Oil and gas extraction and mining (NAICS 21)
  - Utility (NAICS 22); Construction (NAICS 23)
  - Food (NAICS 311); Beverage and tobacco products (NAICS 312)
  - Textile, clothing and leather (NAICS 313, 314, 315, 316)
  - Wood product (NAICS 321); Paper (NAICS 322)
  - Printing (NAICS 323)
  - Petroleum and coal product (NAICS 324); Chemical (NAICS 325)
  - Plastic and rubber products (NAICS 326);
  - Non-metallic mineral products (NAICS 327)
  - Primary metal (NAICS 331); Fabricated metal product (NAICS 332)
  - Machinery (NAICS 333);
  - Computer and electronic product (NAICS 334)
  - Electrical equipment and appliance (NAICS 335)
  - Automotive industry (NAICS 3361, 3362, 3363)
  - Other transportation equipment (NAICS 3364, 3365, 3366, 3369)
  - Furniture (NAICS 337, 339)

- For the services-producing sector, there is an equation for each of the following industry:
  - Wholesale trade (NAICS 41); Retail trade (NAICS 44, 45)
  - Transportation and warehousing (NAICS 48, 49)
  - Information and cultural industries (NAICS 51)
  - Finance and insurance, real estate, rental and leasing (NAICS 52, 53)
  - Professional, scientific, and technical services (NAICS 54)
  - Management and administration and support (NAICS 55, 56)
  - Educational services (NAICS 61); Heath care and social services (NAICS 62)
  - Arts, entertainment, and recreation (NAICS 71)
  - Accommodation and food services (NAICS 72)
  - Public administration (NAICS 91); Other services (NAICS 81)
- The equations generate a projection of GDP for each of the thirty-five industries for the current year and the following year.

Properties

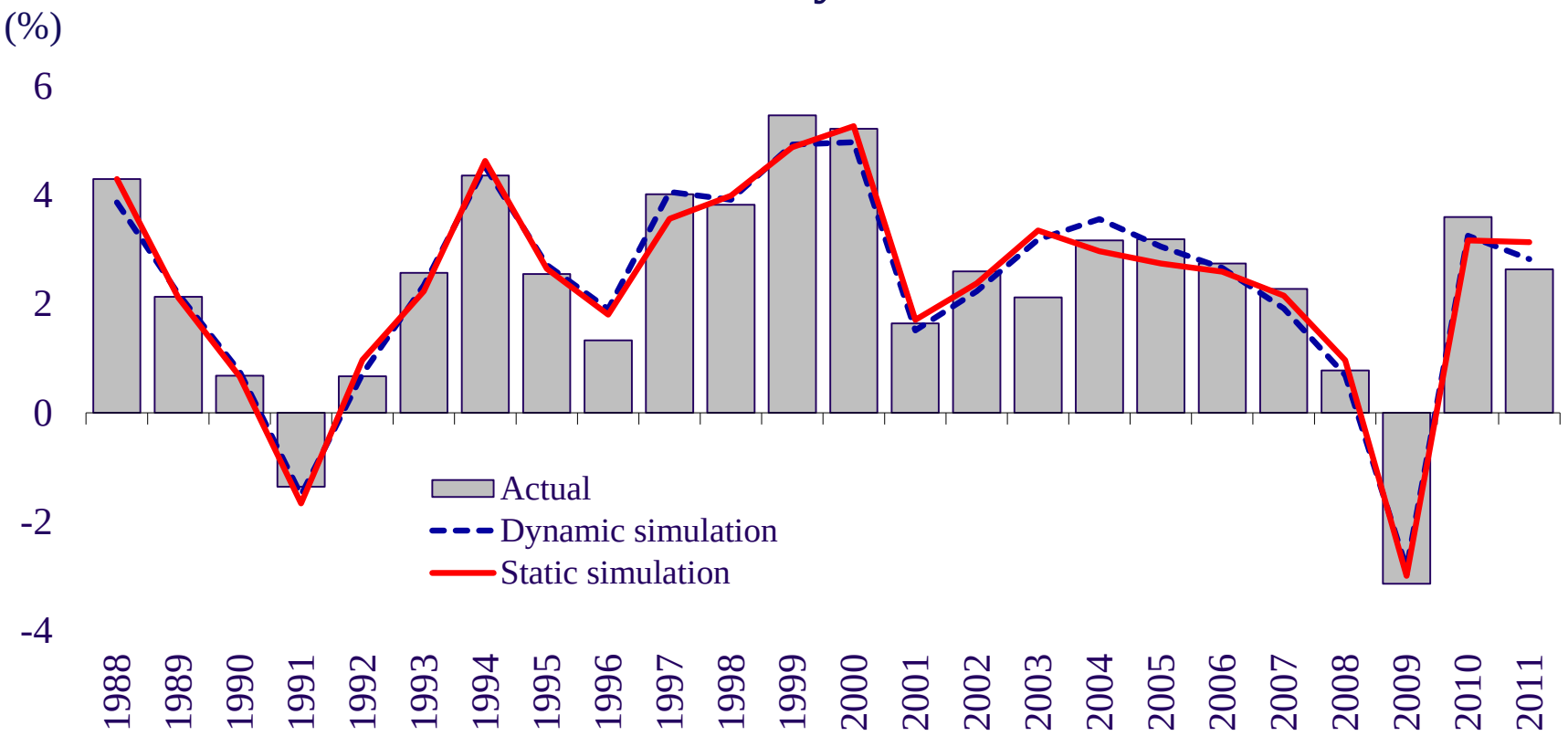
Impact of a Change in Demand and the Exchange Rate on Real GDP by Sector and Industry

Sector	Impact of 1% Increase in Foreign and Domestic Economic Activity	Impact of 10% Appreciation of the Canadian Dollar against the U.S. Dollar
Goods sector	0.9%	-3.4%
Primary	0.5%	0.0%
Construction[1]	0.8%	0.0%
Manufacturing	1.0%	-6.5%
Services sector	0.8%	0.0%
All Industry	0.9%	-1.1%

1. Includes the utility industry.

Forecasting Performance

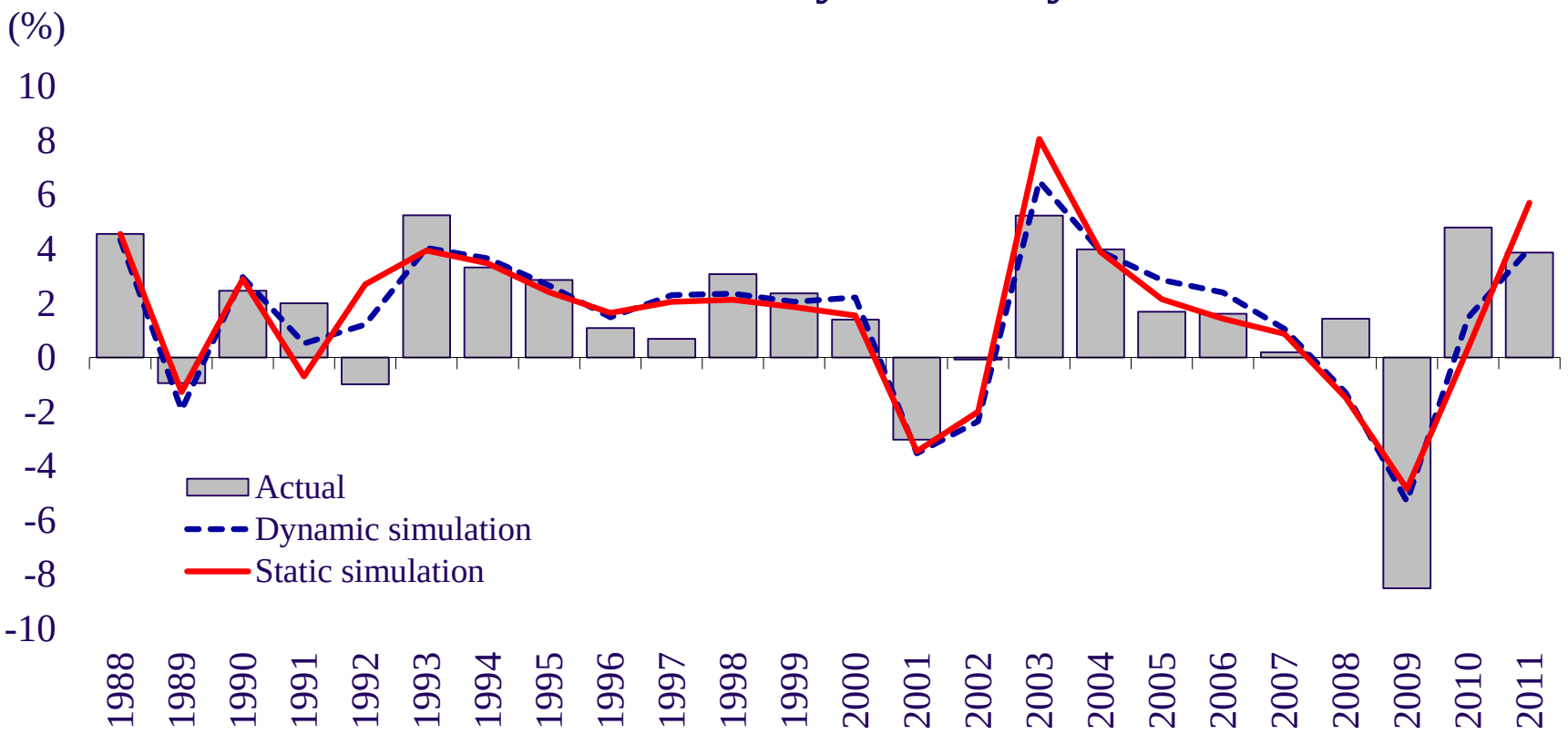
Real GDP Growth in All Industry



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

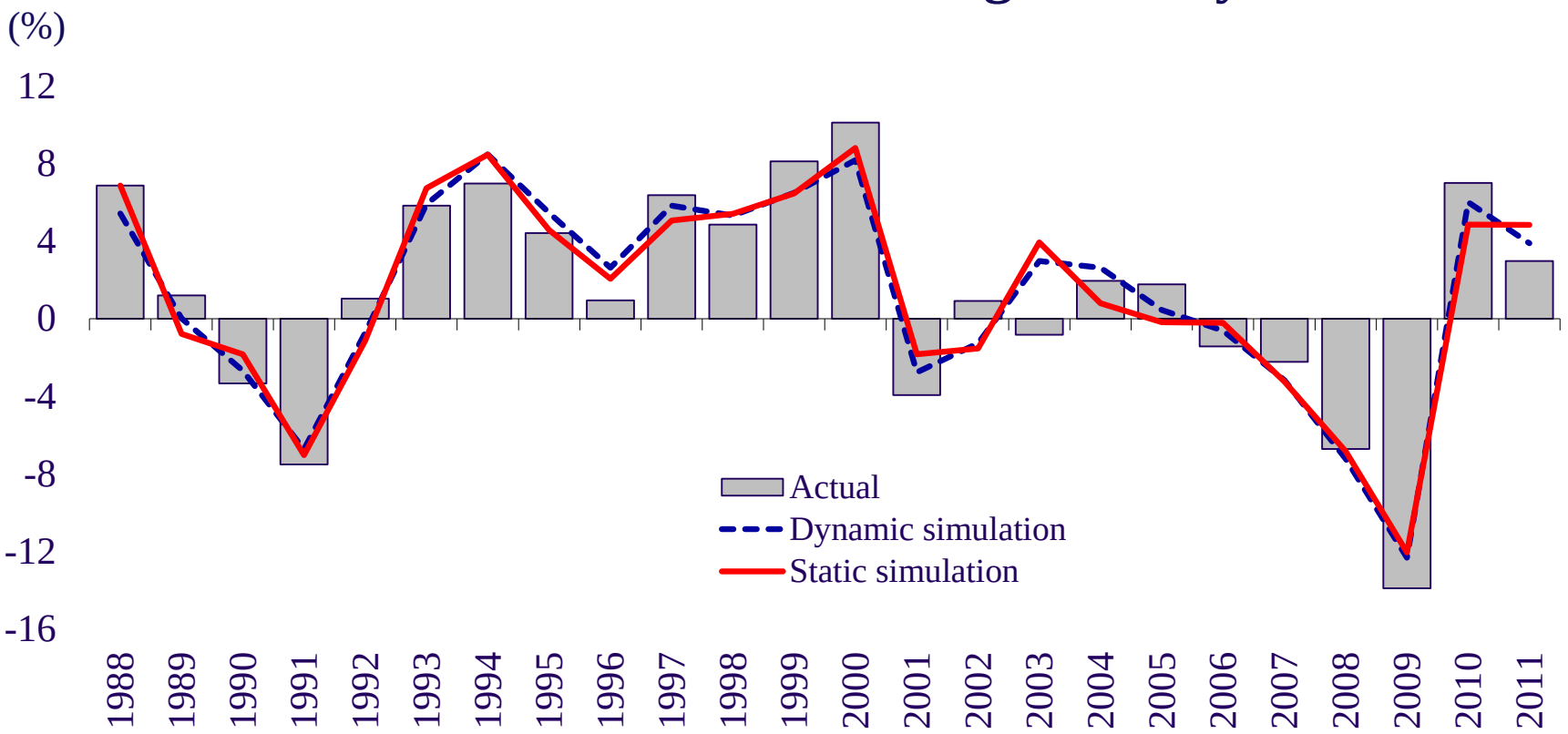
Real GDP Growth in the Primary Industry



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

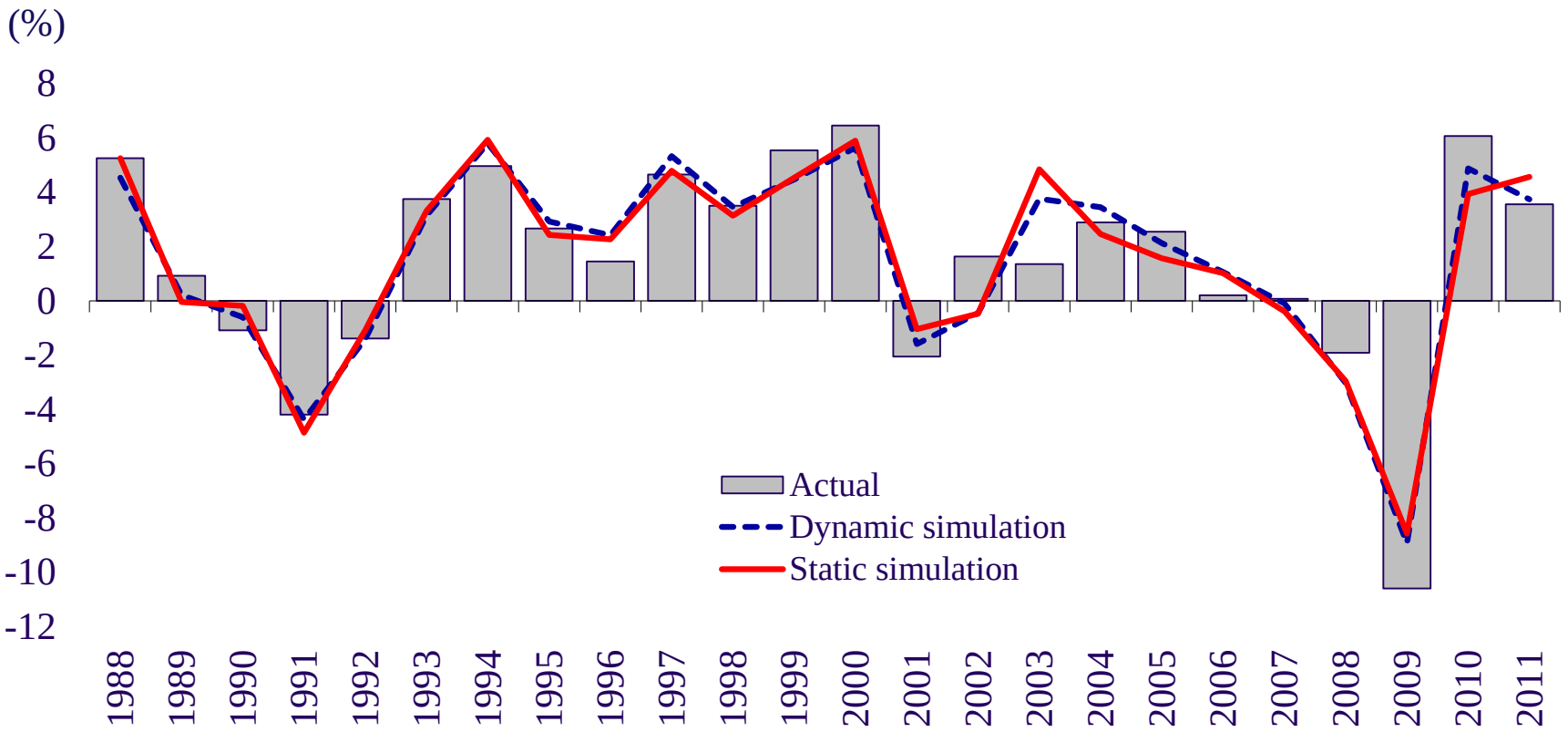
Real GDP Growth in the Manufacturing Industry



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

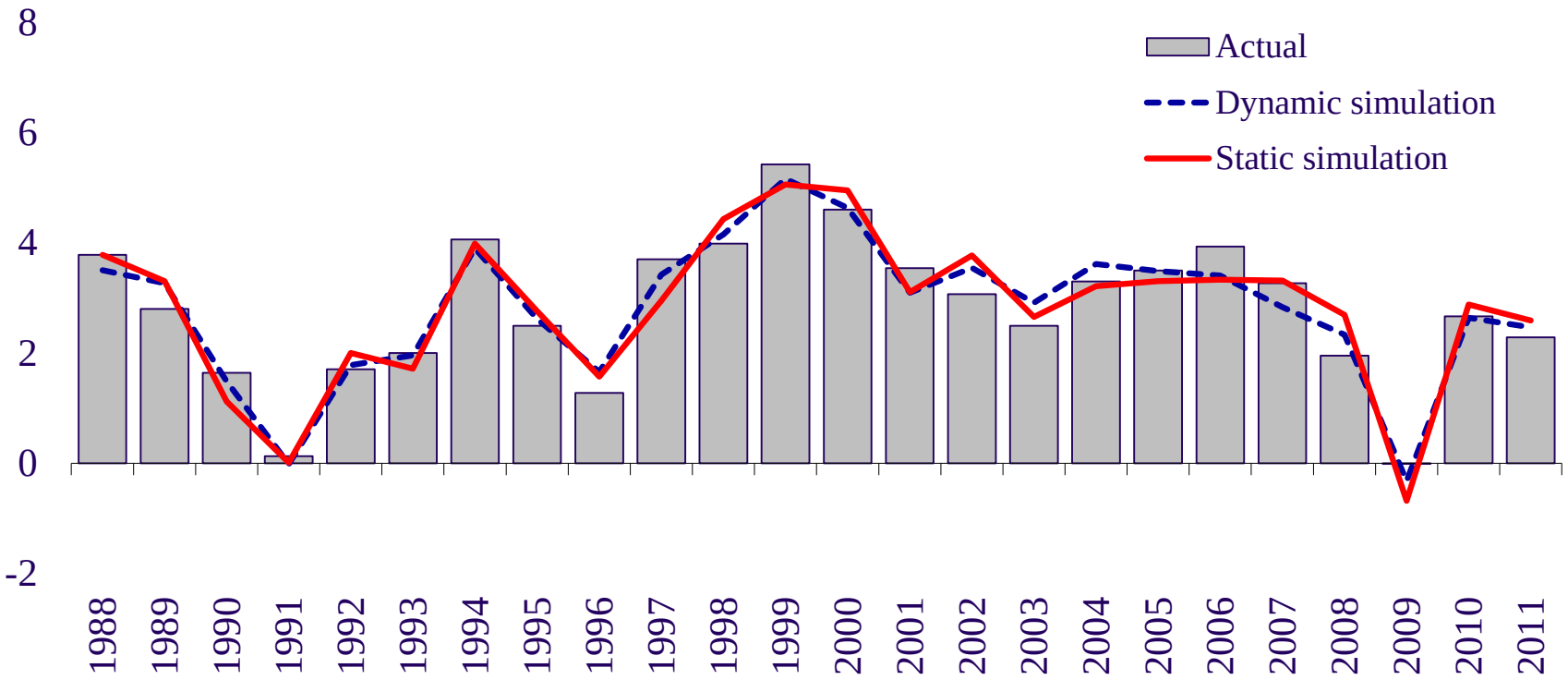
Real GDP Growth in the Goods Sector



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

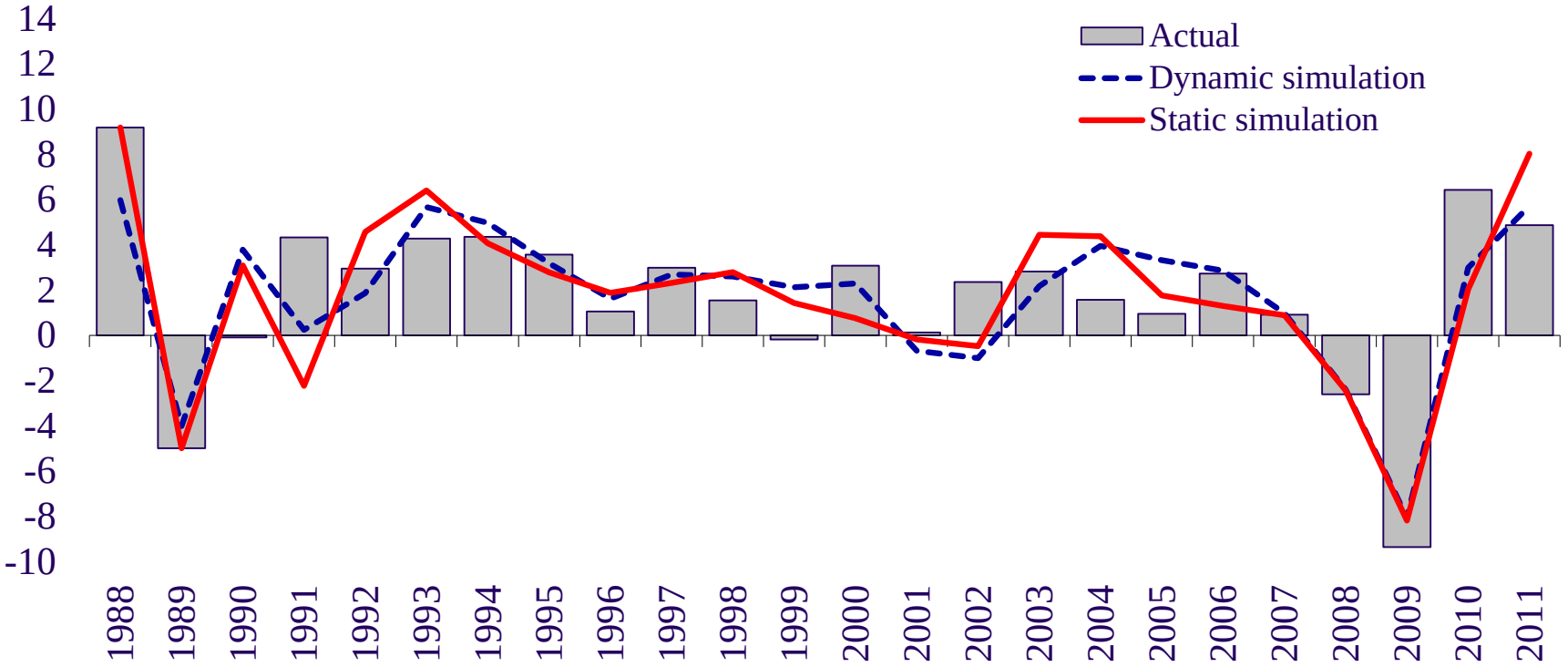
Real GDP Growth in the Services Sector



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Real GDP Growth in Oil and Gas and Mining Industry: In-Sample Forecasting Performance

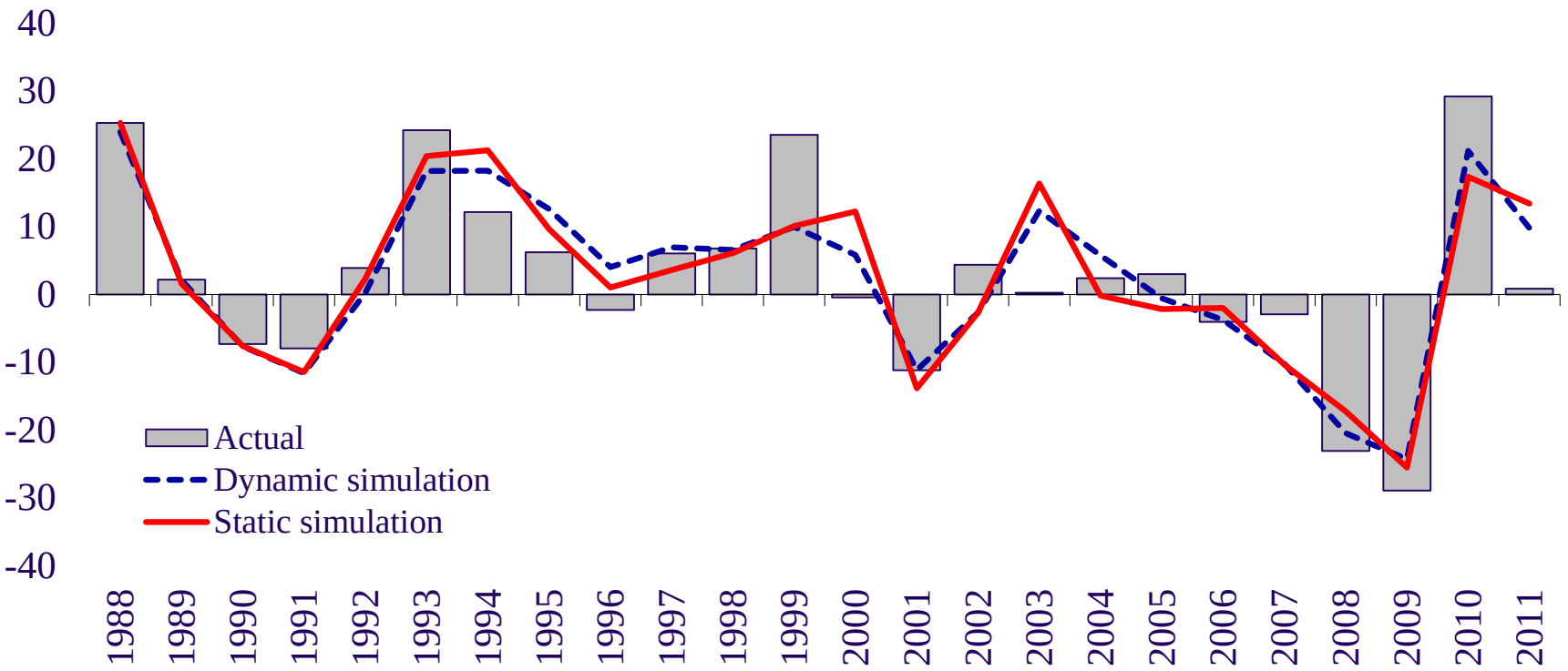
(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Real GDP Growth in Motor Vehicle Industry: In-Sample Forecasting Performance

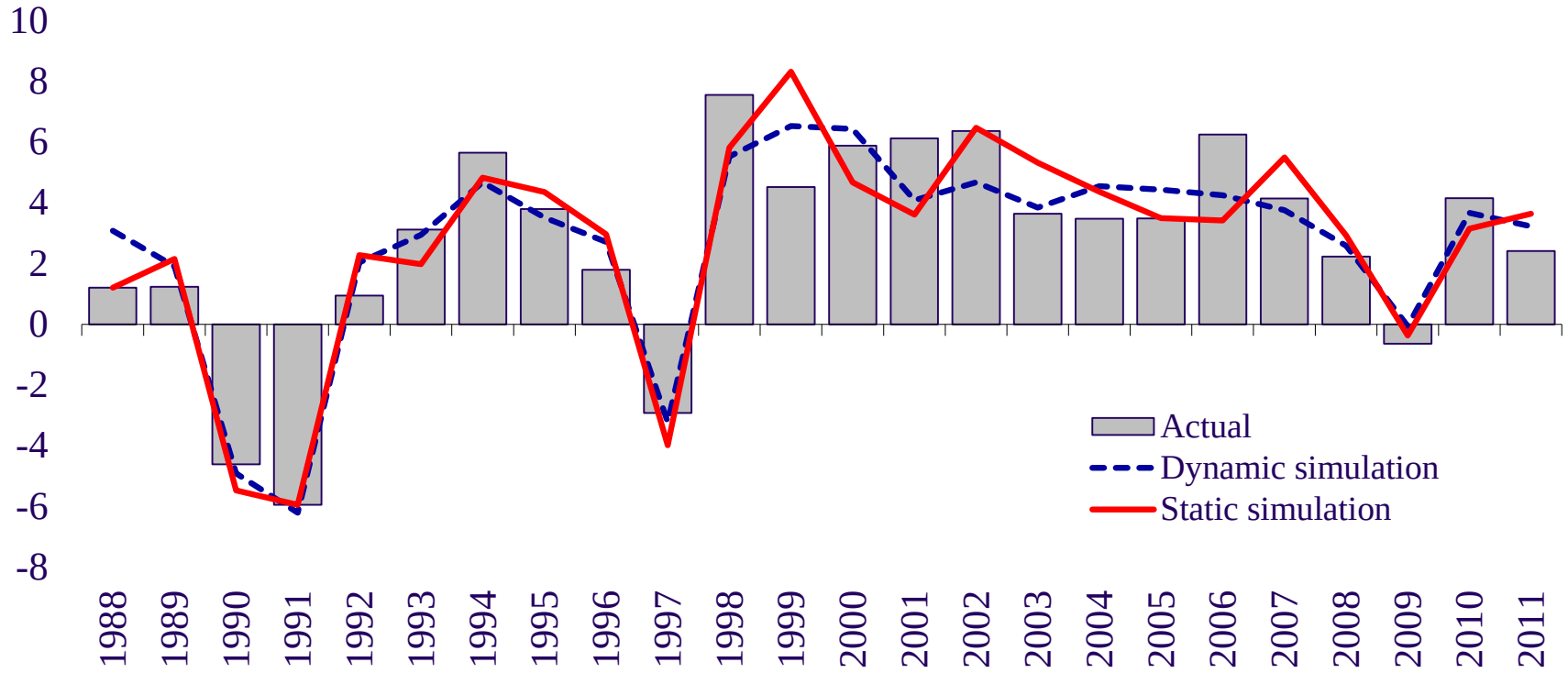
(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Real GDP Growth in the Retail Trade Industry: In-Sample Forecasting Performance

(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Employment by Industry in Canada

Core Drivers

- In the long-term, employment by industry is determined by a number of economic variables, such as :
  - Foreign and domestic economic activity
  - Canada-U.S. exchange rate
  - World commodity prices
- In the short-term, employment by industry is influenced by the changes in the variables listed above plus economic uncertainty (proxy by the change in the unemployment rate).

Description

- The general form of the employment equation by industry is presented below:

$$E^i_t = f(D_{t-i}, EXR_t, V_t, E^i_{t-1})$$

where

- E^i is employment in the industry *i*
- D is a vector of long-term determinants of employment in the industry *i*, such as foreign/domestic economic activity
- EXR is the Canada-U.S. real exchange rate
- V is a vector of short-term determinants of employment in the industry *i*, such as the rate of growth in foreign/domestic economic activity
- E^i is employment in the industry *i* at time *t-1*

- For the goods-producing sector, there is an equation for each of the following industry:
  - Agriculture, forestry, fishing, and trapping (NAICS 11);
  - Mining, quarrying, and oil and gas extraction (NAICS 21)
  - Utility (NAICS 22); Construction (NAICS 23)
  - Food and beverage and tobacco product manufacturing (NAICS 311, 312)
  - Textile mills, textile product mills, clothing and leather allied product manufacturing (NAICS 313, 314, 315, 316)
  - Wood product manufacturing (NAICS 321); Paper manufacturing (NAICS 322)
  - Printing and related support activities (NAICS 323)
  - Petroleum and coal product manufacturing (NAICS 324); Chemical manufacturing (NAICS 325)
  - Plastic and rubber products manufacturing (NAICS 326)
  - Non-metallic mineral product manufacturing (NAICS 327)
  - Primary metal manufacturing (NAICS 331);
  - Fabricated metal product manufacturing (NAICS 332)
  - Machinery manufacturing (NAICS 333);
  - Computer and electronic product manufacturing (NAICS 334)
  - Electrical equipment and appliance manufacturing (NAICS 335)
  - Motor vehicle and parts manufacturing (NAICS 3361, 3362, 3363)
  - Other transportation equipment manufacturing (NAICS 3364, 3365, 3366, 3369)
  - Furniture and miscellaneous manufacturing (NAICS 337, 339)

- For the services-producing sector, there is an equation for each of the following industry:
  - Trade (NAICS 41, 44, 45)
  - Transportation and warehousing (NAICS 48, 49)
  - Information and cultural industries and arts, entertainment, and recreation (NAICS 51, 71)
  - Finance and insurance, real estate, rental and leasing (NAICS 52, 53)
  - Professional, scientific, and technical services (NAICS 54)
  - Management and administration and support (NAICS 55, 56)
  - Educational services (NAICS 61); Heath care and social services (NAICS 62) Accommodation and food services (NAICS 72)
  - Public administration (NAICS 91); Other services (NAICS 81)
- The equations generate a projection of employment for each of the thirty-two industries for the current year and the following year.

Properties

Impact of a Change in Demand and the Exchange Rate on Employment by Sector and Industry

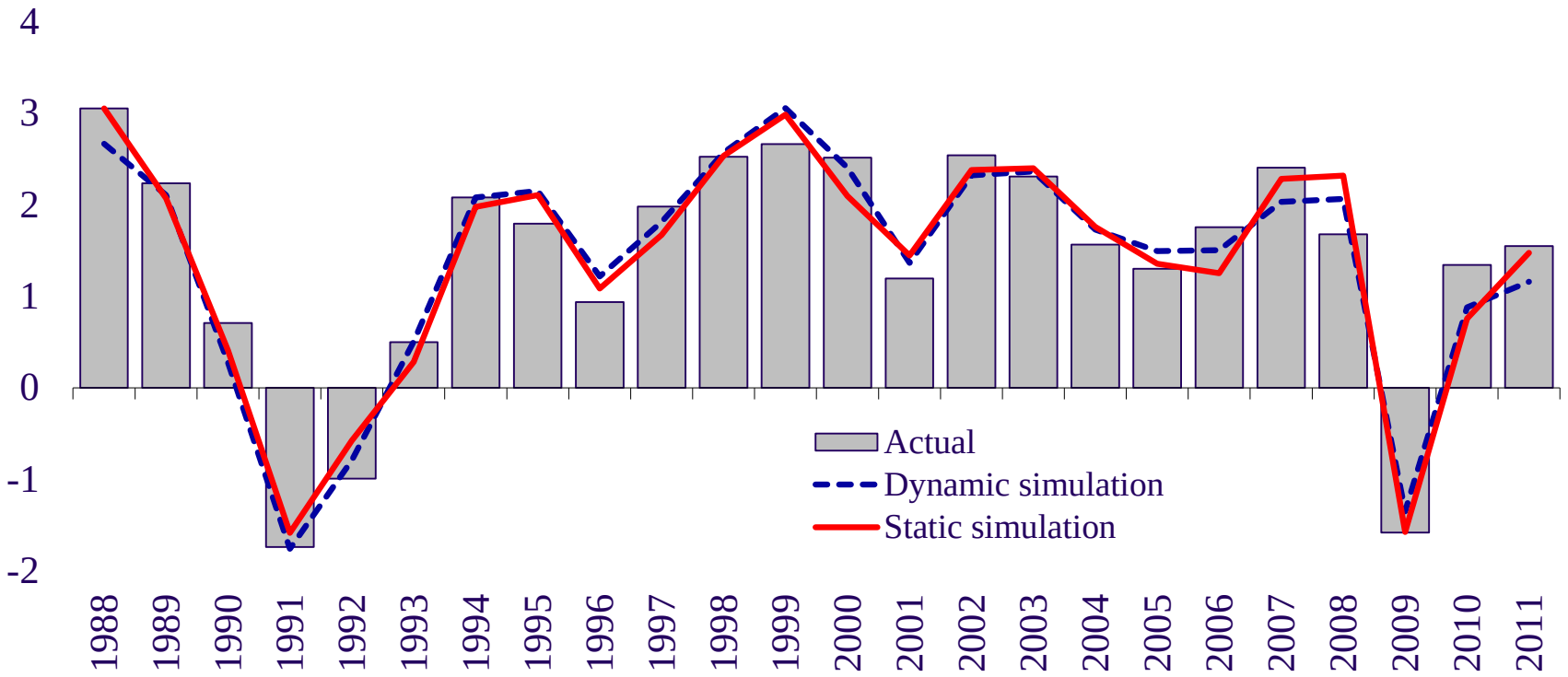
Sector	Impact of 1% Increase in Foreign and Domestic Economic Activity	Impact of 10% Appreciation of the Canadian Dollar against the U.S. Dollar
Goods sector	0.4%	-4.7%
Primary	0.0%	-2.3%
Construction[1]	0.9%	0.0%
Manufacturing	0.3%	-7.4%
Services sector	0.4%	0.0%
All industry	0.4%	-1.2%

1. Includes the utility industry.

Forecasting Performance

Employment Growth in All Industry

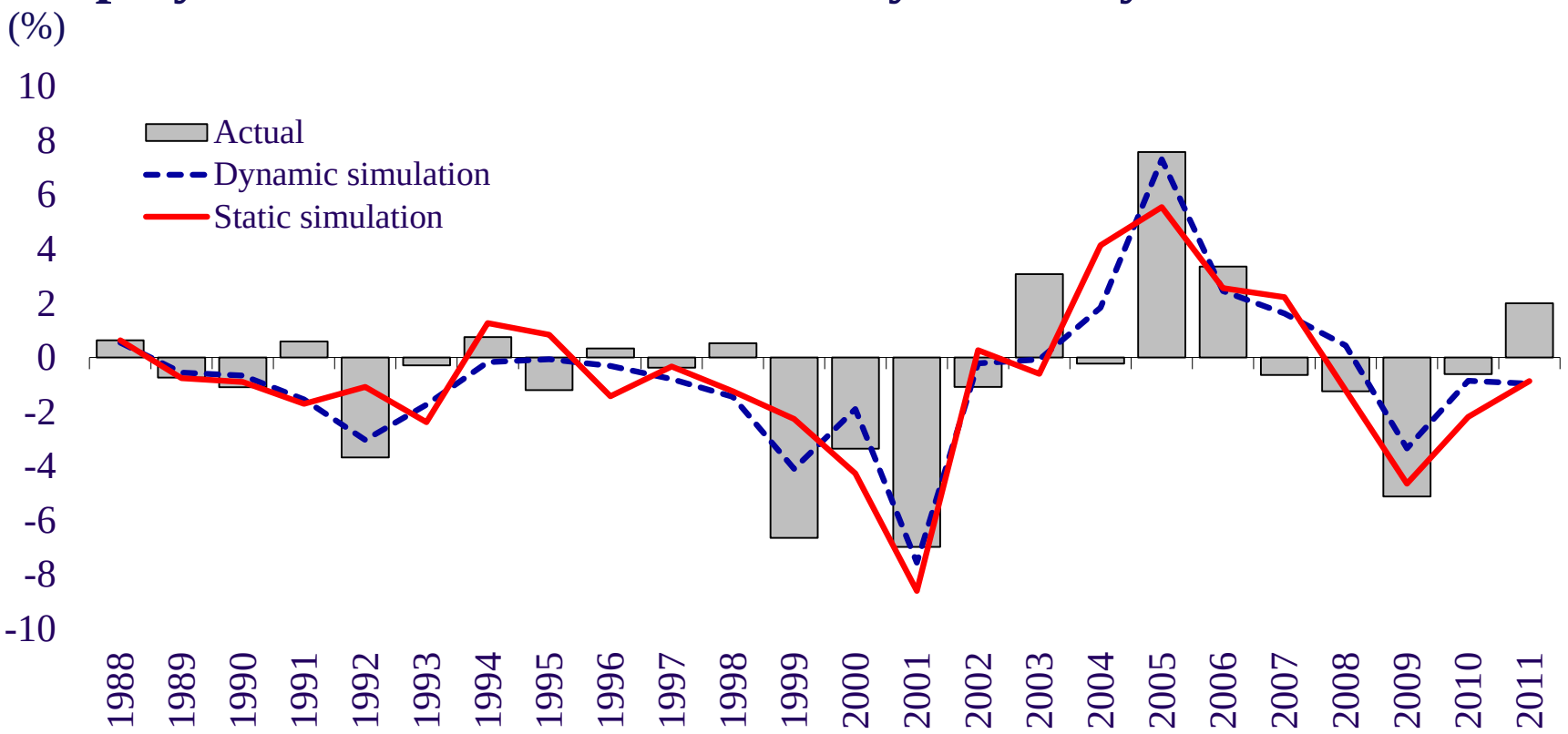
(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

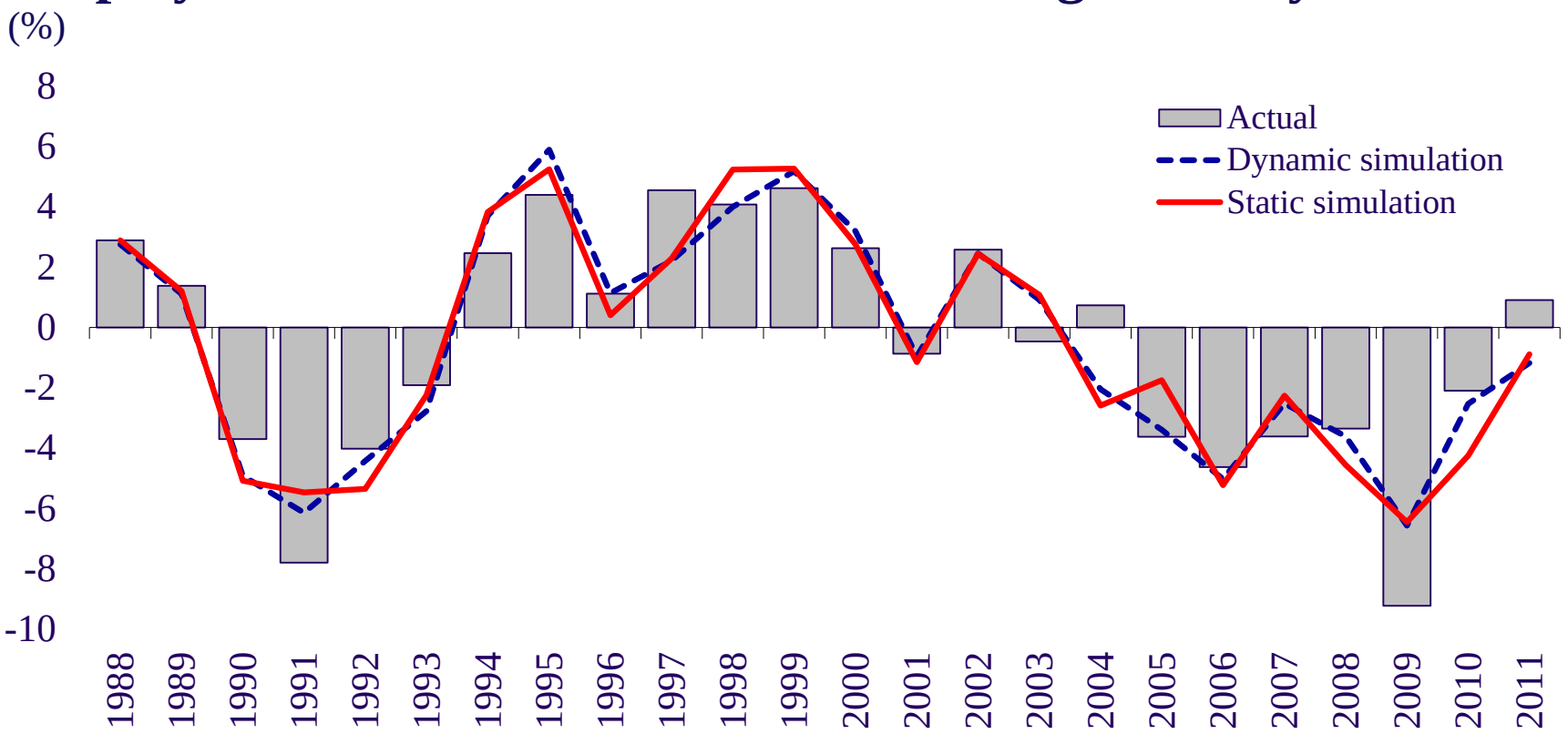
Employment Growth in the Primary Industry



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

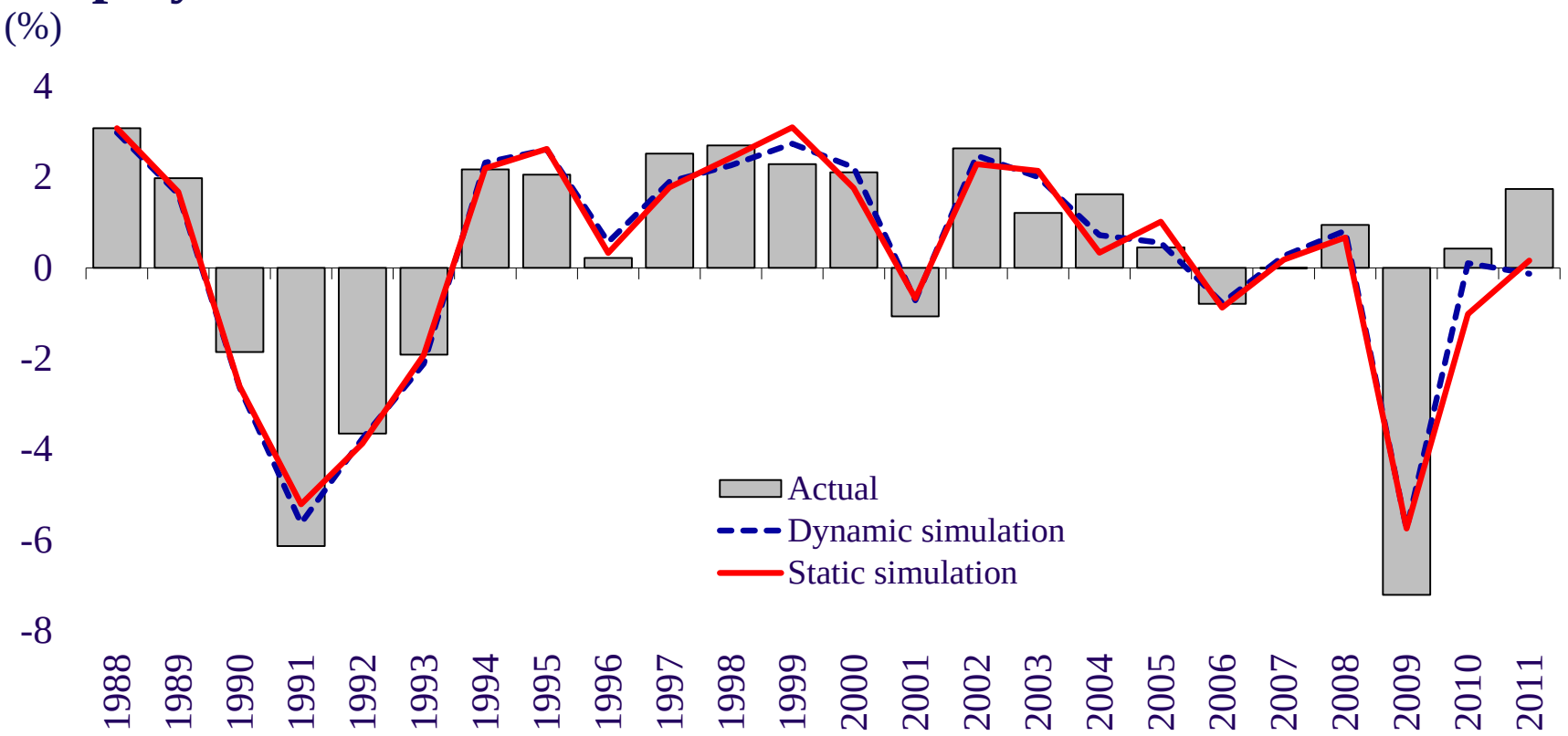
Employment Growth in the Manufacturing Industry



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

Employment Growth in the Goods Sector

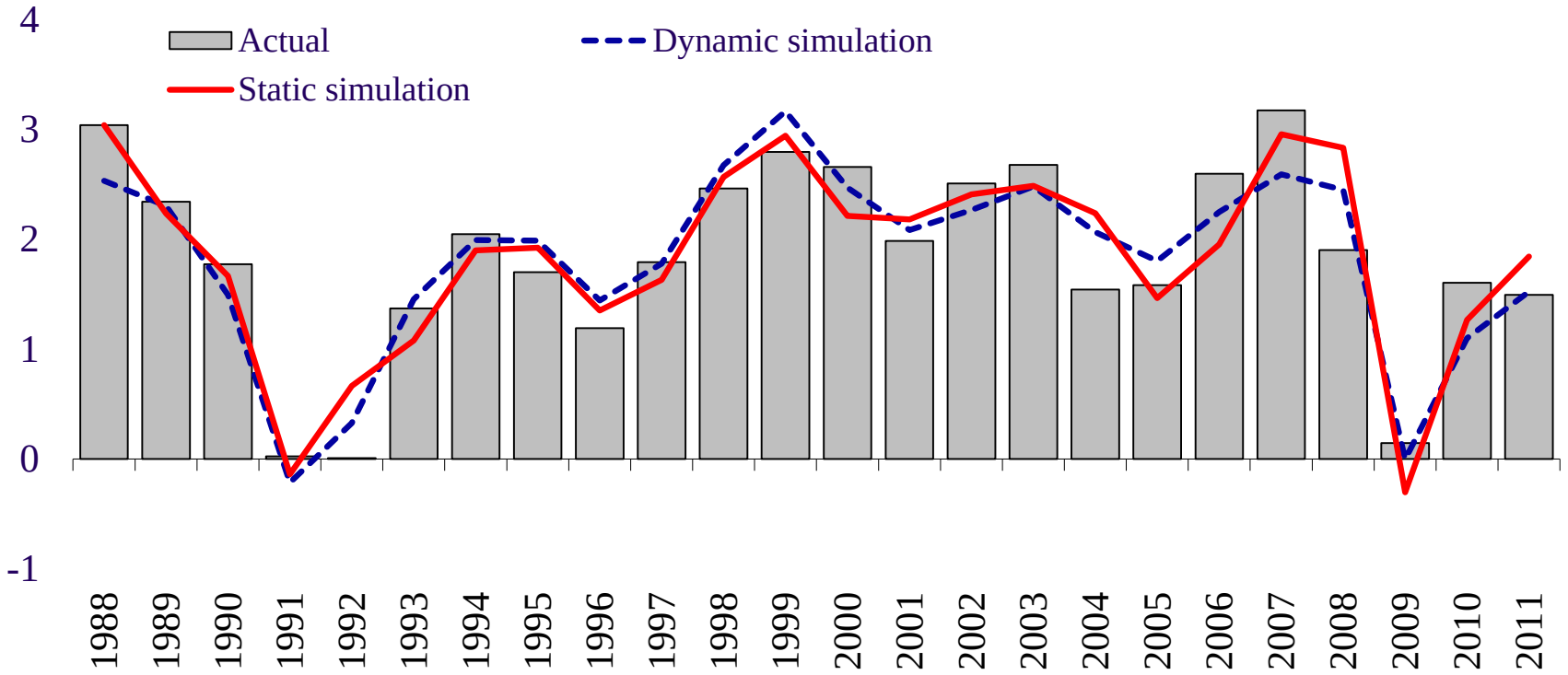


Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Forecasting Performance

Employment Growth in the Services Sector

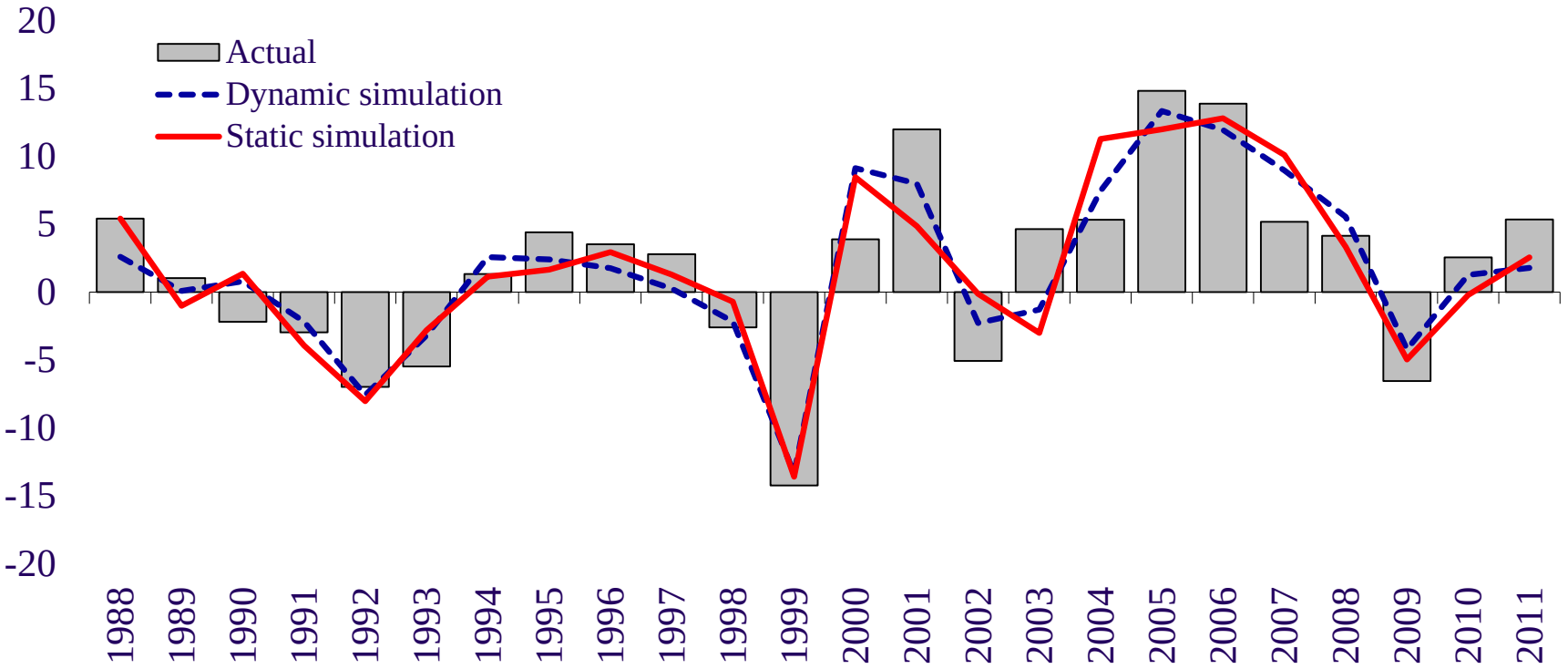
(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Employment Growth in Oil and Gas and Mining Industry: In-Sample Forecasting Performance

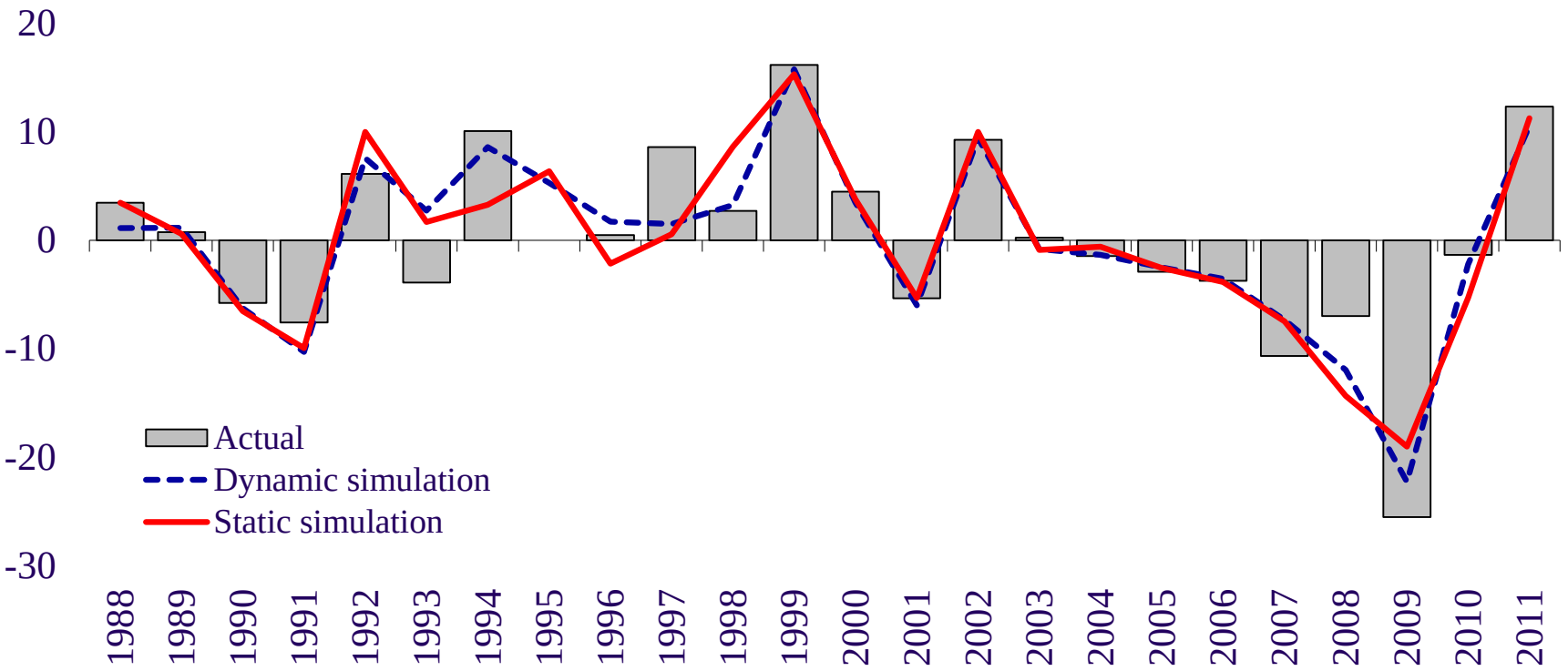
(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Employment Growth in Automotive Industry: In-Sample Forecasting Performance

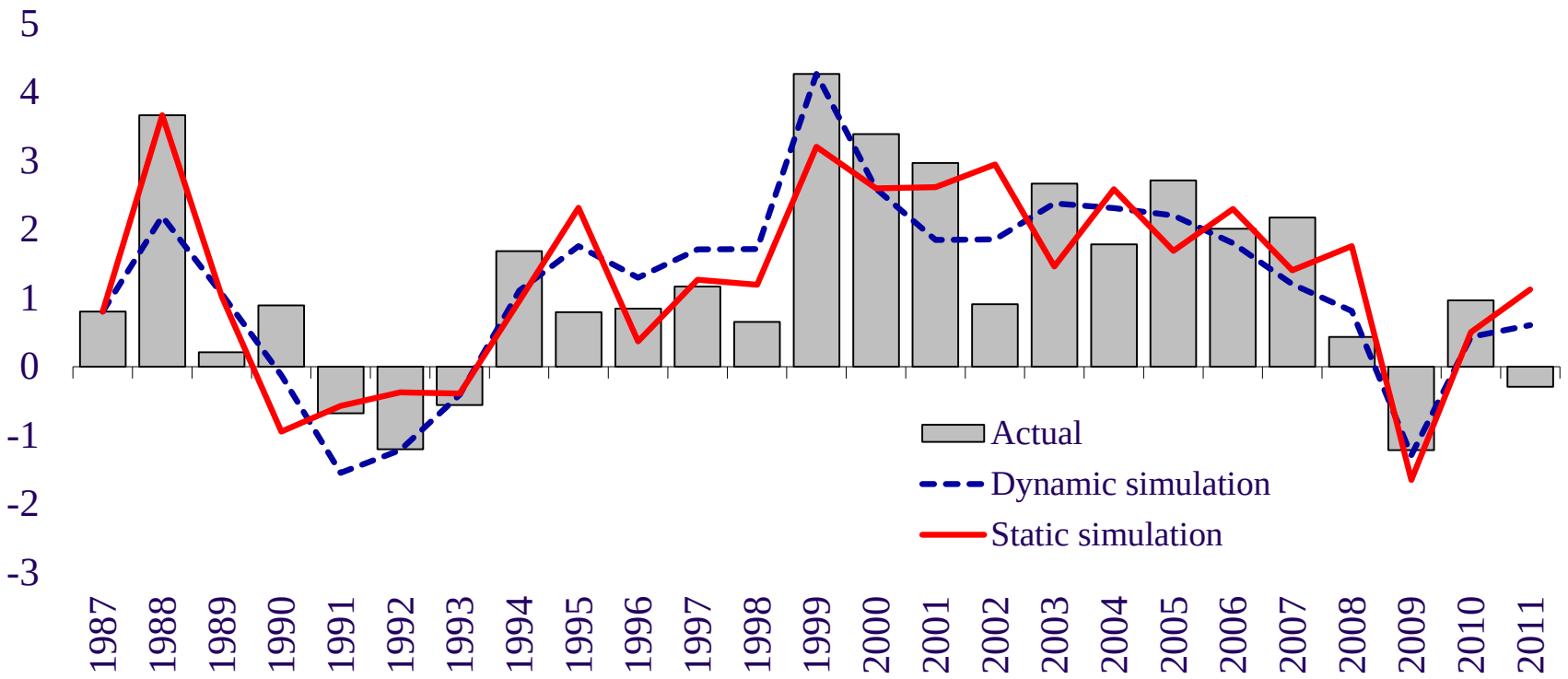
(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Employment Growth in the Trade Industry: In-Sample Forecasting Performance

(%)



Sources: Statistics Canada (actual data) and The Forecasting Advisor (simulation).

Thanks!