

ROBUSTNESS CHECKS FOR BANKS' LOAN PORTFOLIO AND THE MONETARY TRANSMISSION MECHANISM*

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Abstract

This is an additional appendix of Den Haan, Sumner, and Yamashiro (2005). We document the robustness of our key findings and gives the results when loans are not disaggregated into loan components. We show that the results are robust to changes in the specification of the VAR as well as to different measure of real activity and monetary policy. In addition, we show that the results based on loan series from the CALL reports are very similar to those based on the H8 loan series.

1 Introduction

In the first section, we discuss the alternative data used in the robustness checks. In the second section, we document the robustness of the results when alternative data are used, as well as when alternative VAR specifications are used. In the

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third section, we present the results when total loans are not disaggregated into its components.

2 Additional data

In this appendix, we compare the results using data from the Call Reports with (seasonally adjusted) bank loan variables provided by the Federal Reserve System in the "Assets and Liabilities of Commercial Banks" data set (H.8). The H8 data start in January 1960 and end in February 2003. We use the bank universe that includes all commercial banks.¹ The measure for real activity is the seasonally adjusted series for Industrial Production from the Federal Reserve System (G.17). The price index used is the seasonally adjusted CPI. We will refer to this data set as the monthly-H8 data set. This appendix also uses GDP and real GDP (chained 2000\$) downloaded from <http://research.stlouisfed.org/fred2/>.

3 Robustness

For the robustness checks we use a slightly older version of the quarterly Call Report data that runs from the first quarter of 1977 to the last quarter of 2000. We will refer to this data set as the quarterly-short-CALL data set.² We document below that the results based on this older data set are very similar to those reported in the main text of the paper that are based on the most recent Call data set. Because of the strong similarity we did not repeat the battery of robustness checks when we updated the results in the main text.

The first subsection looks at alternative data sets. In particular, it looks at the monthly-H8 data set. The second subsection looks at different specifications of the VAR and the last two subsections document the robustness of the results when alternative measures of real activity and monetary tightening are used.

¹The universe of domestically-chartered commercial banks in the H8 is virtually identical to the set of commercial banks available in the Call reports. The H8 series for domestically-chartered banks only starts in 1973, however, so we instead use the H8 series for all commercial and industrial banks. Besides domestically-chartered banks the H8 series for all commercial banks includes: branches and agencies of foreign banks, state-licensed agencies acting as a bank, Edge-Act corporations, New York investment companies, and the American Express International Banking Corporation. This information was provided to us by William Watkins of the Board of Governors of the Federal Reserve System. See Den Haan, Sumner, and Yamashiro (2002) for details.

²Available at <http://www.csulb.edu/~gyamashi/CallReportData.html>. The longer data set not only has fourteen more quarters but also includes some revisions for observations in the shorter data set.

3.1 Alternative loan series

Figure A.1 reports the responses of the loan components during a monetary and non-monetary downturn estimated with the quarterly-short-CALL data. The results are very similar to those reported in the main text, which are based on the updated and extended data series. The only difference is that for the shorter sample, consumer loans display an occasionally significant decline during a non-monetary downturn. In both samples, however, the estimated decline during a monetary downturn relative to the decline during a non-monetary downturn is negative.

Figure A.2 reports the results for the monthly-H8 series, which starts much earlier than the Call Report series (namely in 1960) and uses monthly observations. The results are very similar. One difference is that a larger number of estimated responses are significantly different from zero, which is not surprising given the longer sample length. The only qualitative difference is that during a monetary downturn no sharp increase in C&I loans is observed. Relative to the decline observed during a non-monetary downturn, however, C&I loans increase.

The question arises as to what is driving the differential response of C&I loans during a monetary downturn. Recall that the H8 series are based on voluntary surveys, while the Call Reports are based on mandatory filings. This is not the source of the difference, however. In Figure A.3 we report the results for the case when the Call Report series are replaced by the quarterly-H8 series, which is created by taking quarterly averages of the monthly-H8 data, using the sample from 1977 to 2000. We see that the response of C&I loans estimated using the quarterly-H8 series also displays an increase during a monetary downturn. Quantitatively, the response estimated using the quarterly-short-CALL data is stronger than the response estimated using the quarterly-H8 data. In Figure A.4 we compare the responses of C&I loans using the quarterly-short-CALL (same as in panel A of Figure A.1) and quarterly-H8 data for domestically chartered banks. The results are fairly similar implying that the main difference between the Call and the H8 data is due to the fact that the H8 data includes branches of international banks.

The main empirical finding stressed in the paper is that, relative to the response following output shocks, C&I loans increase during a monetary downturn, while real estate and consumer loans decrease. The robustness of this result across the different data sets comes out very clearly in Figure A.5, which plots the differences between the monetary and non-monetary responses. We see that each differential response is significantly different from zero at many forecast horizons and that the pattern is very robust across data sets.

3.2 Alternative VAR specification

The benchmark specification includes one year of lags, a constant, a linear trend, and in the case of the Call data, quarterly dummies. We tried several other specifications and found that the results reported for the loan components are robust to changes in the VAR specification, even for the shorter data sets that start in 1977. Here we report the results based on a VAR specification that is selected by BIC. We choose the model with the lowest value for BIC in a class of models that allows for a linear trend, a quadratic trend, and up to one year of lags.³ For the Call data we also allow for quarterly dummies. The chosen specifications are reported in Table A.1. Since BIC imposes quite a strong penalty for additional parameters it chooses a specification that is much more concise than our benchmark VAR specification.

Figures A.6, A.7, and A.8 plot the impulse response functions for the loan components for a monetary and a non-monetary downturn for the three different data sets. We see that the results are very similar to those reported in Section 3 of the main paper. That is, the response of C&I loans during a monetary downturn is not less than the response during a non-monetary downturn and for the data sets that start in 1977 the response during a monetary downturn is clearly positive.⁴ For real estate and consumer loans the response during a monetary downturn is negative and below the response during a non-monetary downturn. One difference with the results reported in the text is that the impulse response for real estate loans for a monetary downturn for the quarterly-short-CALL data set has no significant coefficients.

3.3 Alternative real activity series

To be consistent with our work on the regional effects of monetary policy shocks, we used the personal income series available from the BEA and the consumer price index. The results are very similar, however, when GDP and its deflator are used, with a couple of minor exceptions. For example, if we use GDP and its deflator with the quarterly-short-CALL data set then we find that in response to a negative monetary policy shock the initial positive response of GDP is larger. Moreover, the response is positive for two quarters, while using the BEA measure the response is positive for only one quarter. This more positive response of output makes the initial

³For the monthly data we set the minimum number of lags equal to three months and for the quarterly data sets we set the minimum number of lags equal to two quarters.

⁴One exception is that for the monthly-H8 data sample from 1960 to 2003 C&I loans actually do decrease substantially during a monetary tightening. When we add more lags of the interest rate and output to the equation for C&I loans, however, then the results are again very similar to those reported in the main text.

response of C&I loans during a non-monetary downturn somewhat more positive too.⁵ In Figure A.9 we document the similarity for the differential responses of the loan components.

3.4 Romer and Romer policy measure

We also checked whether the results are robust to using the measure of monetary policy shocks proposed by Romer and Romer (2004). A disadvantage of this measure is that it is only available through 1996. Panel A of Figure A.10 documents that with this policy measure the response of the price level is somewhat less problematic, but it still increases immediately after the tightening and never displays a serious decline.⁶ In particular, the graph compares the response for the price level when the Romer and Romer measure is used (for the sample from 1977 to 1996) with the response when the innovation to the federal funds rate is used as the policy measure (using both the sample from 1977 to 2000 as well as the sample from 1977 to 1996). Panel B of the same figure plots the response of the federal funds rate for the different policy measures. The results are fairly similar but the response of the federal funds rate returns to zero faster when the Romer and Romer measure is used. Figure A.11 shows that the responses of the loan components are remarkably robust for the two different measures of a monetary tightening. One difference is that—analogueous to the response of the federal funds rate—the loan responses return to zero faster when the Romer and Romer measure is used.

4 Impulses of total loans

The empirical finding that the loan components move in opposite directions after a monetary tightening makes clear why the literature has not been able to find a robust response of total loans to a monetary tightening. To facilitate the comparison with the results for the three loan components we use the sum of the three loan components as the total loans series. While these three loan components do not cover all bank loans, however, their sum equals roughly 85% of all bank loans. Not surprisingly, the sum of the three components and all bank loans are highly

⁵The reasons is that when we use GDP we also find that C&I loans follow the real activity measure in response to an output shock.

⁶The results for the Romer and Romer measure were scaled to give the same first-period response for the federal funds rate as was found when the innovation in the federal funds rate was used as the policy measure.

correlated.⁷ Results that use the actual total loan series are very similar. Here we report the results found with a system that includes total bank loans as the only loan variable.⁸ We document that the results for total loans are not robust.

The results discussed in this section are based on a VAR that includes the federal funds rate, a price index, a real activity measure, and total loans. All VARs include one year of lagged variables, a constant, and a linear trend. We also include quarterly dummies when we use the data from the Call reports since these are not adjusted for seasonality.

In Figure A.12 we plot the behavior of total loans during a monetary and a non-monetary downturn for the three data sets, and in Figure A.13 we plot the difference between these two responses. Panel B in these two figures shows that the behavior of total loans in the sample starting in 1960 is consistent with the perceived wisdom about what happens during the monetary transmission mechanism. That is, total loans display a substantial and significant drop. Interestingly, while Bernanke and Blinder (1992) find that the total loan variable has a delayed response and falls at the same time as output we find that it drops quite rapidly and before output. Moreover, while during a non-monetary downturn total loans also drop, the decline is smaller than what we observe during the monetary downturn. Therefore, the results are consistent with an interest-rate channel as well as a credit crunch in total bank loans during a monetary tightening.

For the two samples that starts in 1977, however, the results differ.⁹ Although the behavior of total loans during a non-monetary downturn is very similar across all data sets, total loans actually *increase* during a monetary tightening according to the impulse response functions estimated with the data sets that begin in 1977.¹⁰ Consequently, when we look at the difference between the behavior of total loans during a monetary and a non-monetary downturn in Figure A.13 we see that the difference is negative for the monthly-H8 data that starts in 1960 and positive for the two data sets that start in 1977. The results for the samples that start in 1977,

⁷The correlation between the log change of the sum of the three loan components and the log change of all bank loans is equal to 0.84.

⁸The response of total loans in a log-linear system with loan components is in general time varying and depends on the relative magnitudes of the loan components when the shock occurs. Den Haan, Sumner, and Yamashiro (2004) analyze the responses of total loans implied by the VAR with loan components and find that the time variation is substantial.

⁹The differences between the results for the monthly-H8 data set, starting in 1960, and the results for the two quarterly data sets, both starting in 1977, are due to the difference in the time period covered and not, for example, to differences in sampling frequency. If we estimate the VAR using data from the monthly-H8 that begins in 1977, then the results are similar to those obtained with the two quarterly data sets.

¹⁰Note, however, that only the first response is significant.

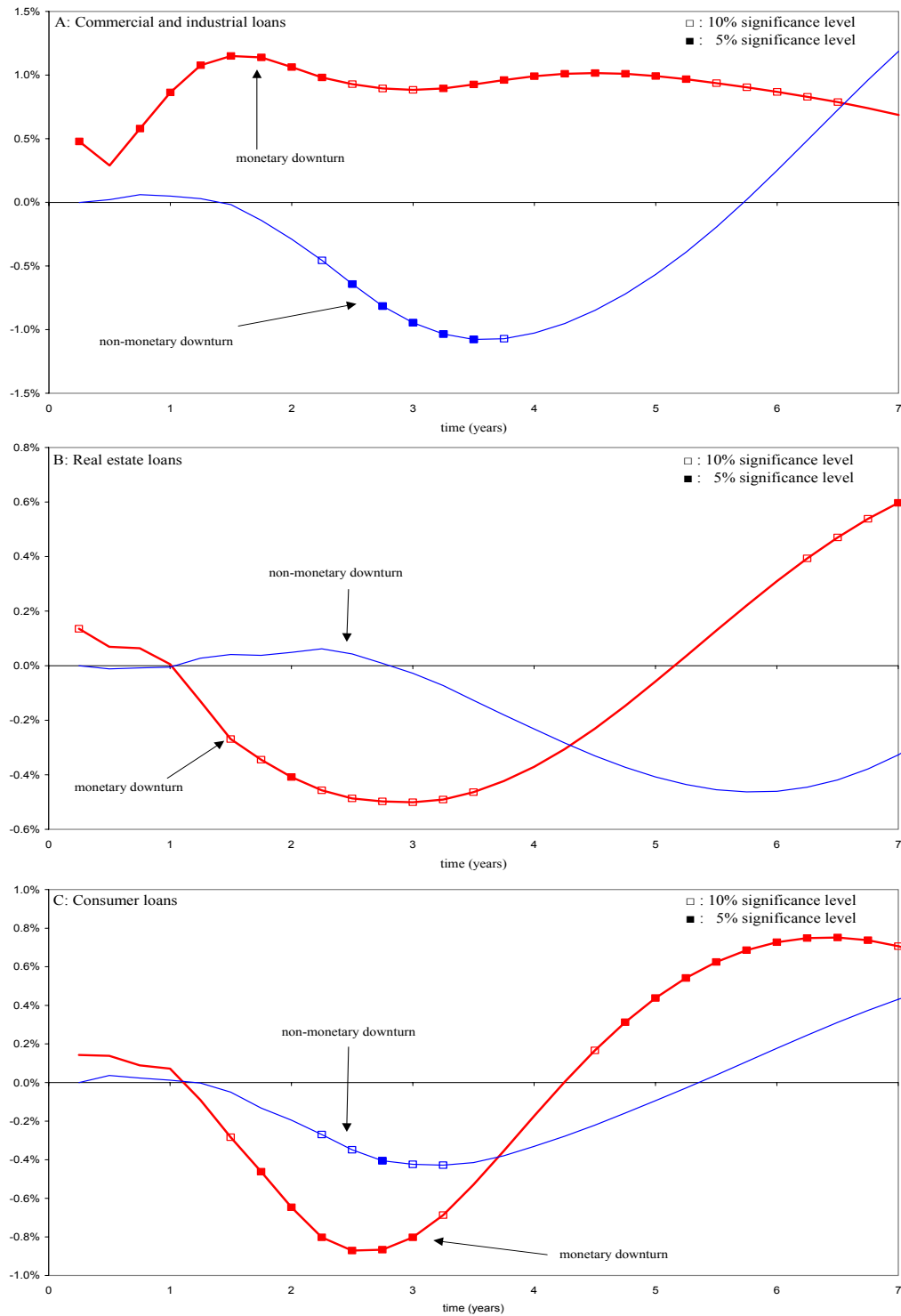
however, are not significant and not robust. For example, if one estimates the VAR with only two lags instead of four then the response of total loans during a monetary downturn and a non-monetary downturn are more similar to the one found for the longer data set, although none of the responses are significant. These results are reported in Figure A.14.

Given that the results are neither robust nor significant one might conclude that after 1977 loans do not respond to a monetary tightening or—more precisely—that the data do not have the information necessary to reveal a convincing pattern. The results for the loan components, however, display robust and significant responses after a monetary tightening.

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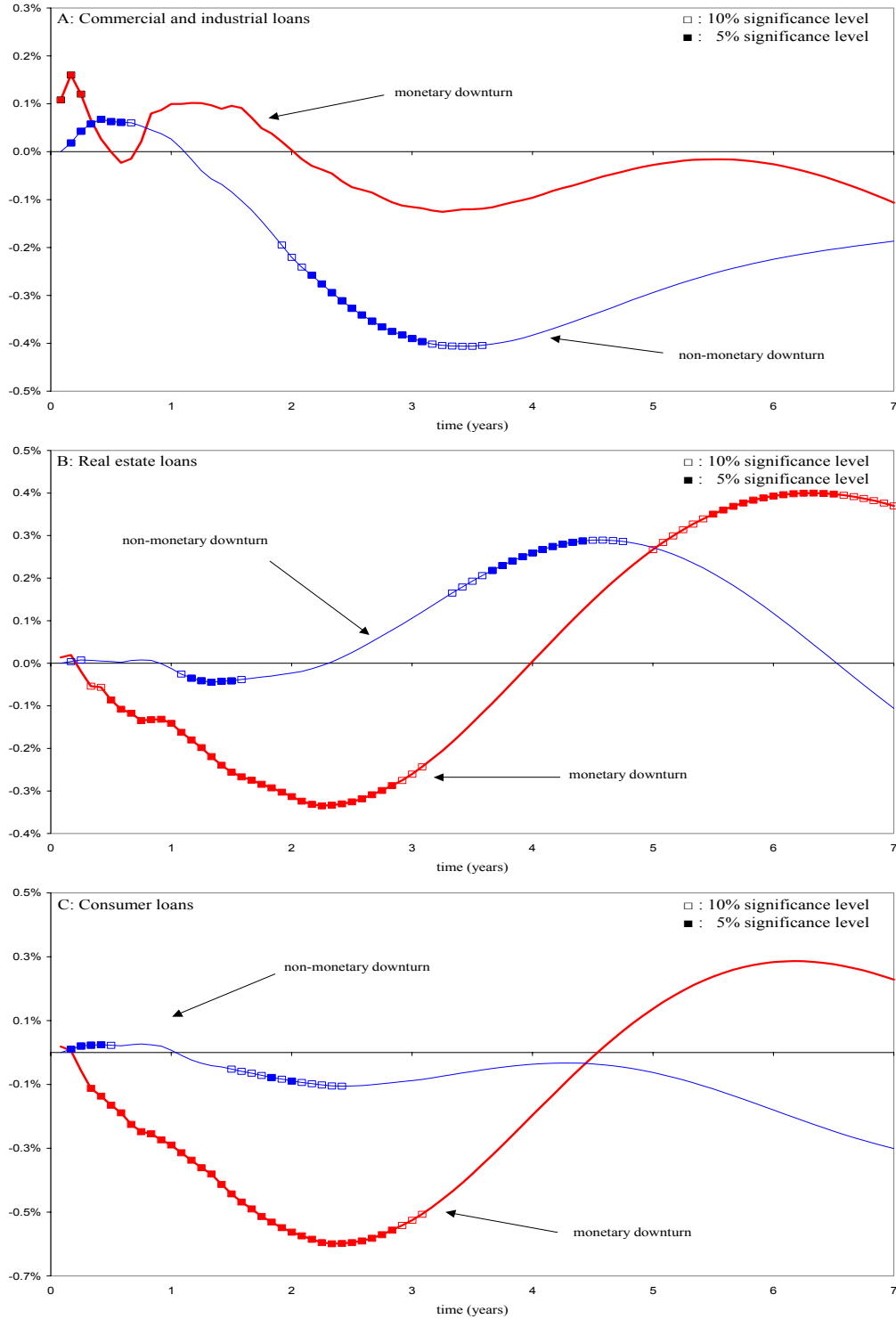
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Figure A.1: Loan component impulse responses
Quarterly-Short-CALL (1977:1 – 2000:4)



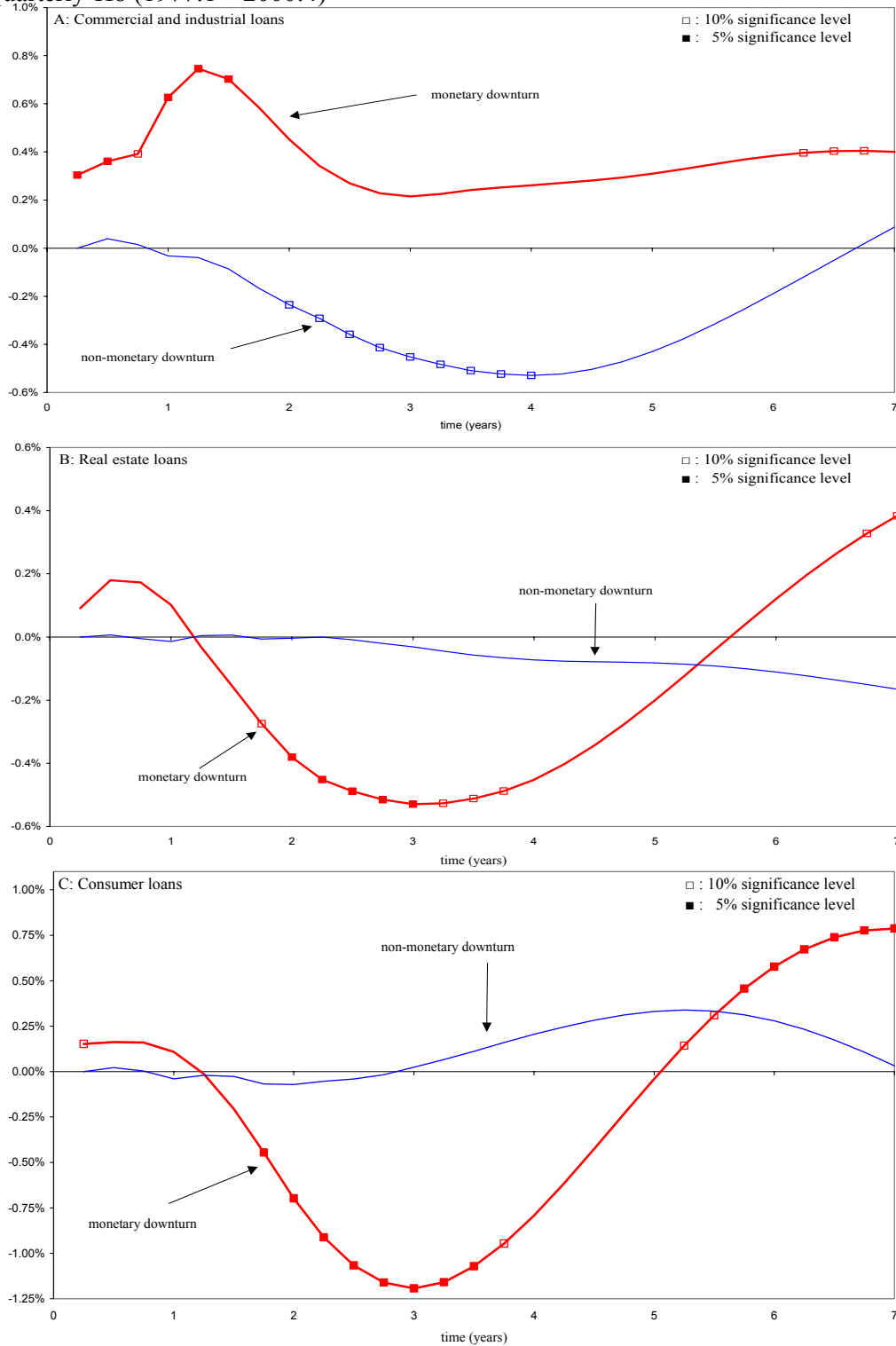
Note: These graphs plot the response of the indicated loan variable to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn. The curve labelled “non-monetary downturn” plots the time path of the loan variable following a sequence of output shocks that generates a time path for output that is identical to that of the monetary downturn. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.2: Loan component impulse responses
Monthly-H8 (January 1960 – February 2003)



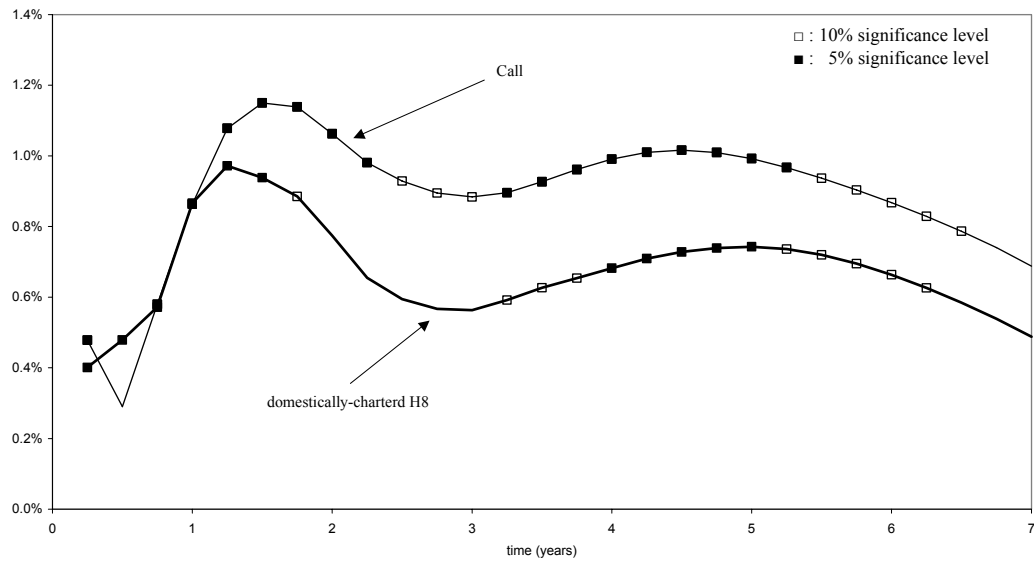
Note: These graphs plot the response of the indicated loan variable to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn. The curve labelled “non-monetary downturn” plots the time path of the loan variable following a sequence of output shocks that generates a time path for output that is identical to that of the monetary downturn. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.3: Loan component impulse responses
Quarterly-H8 (1977:1 – 2000:4)



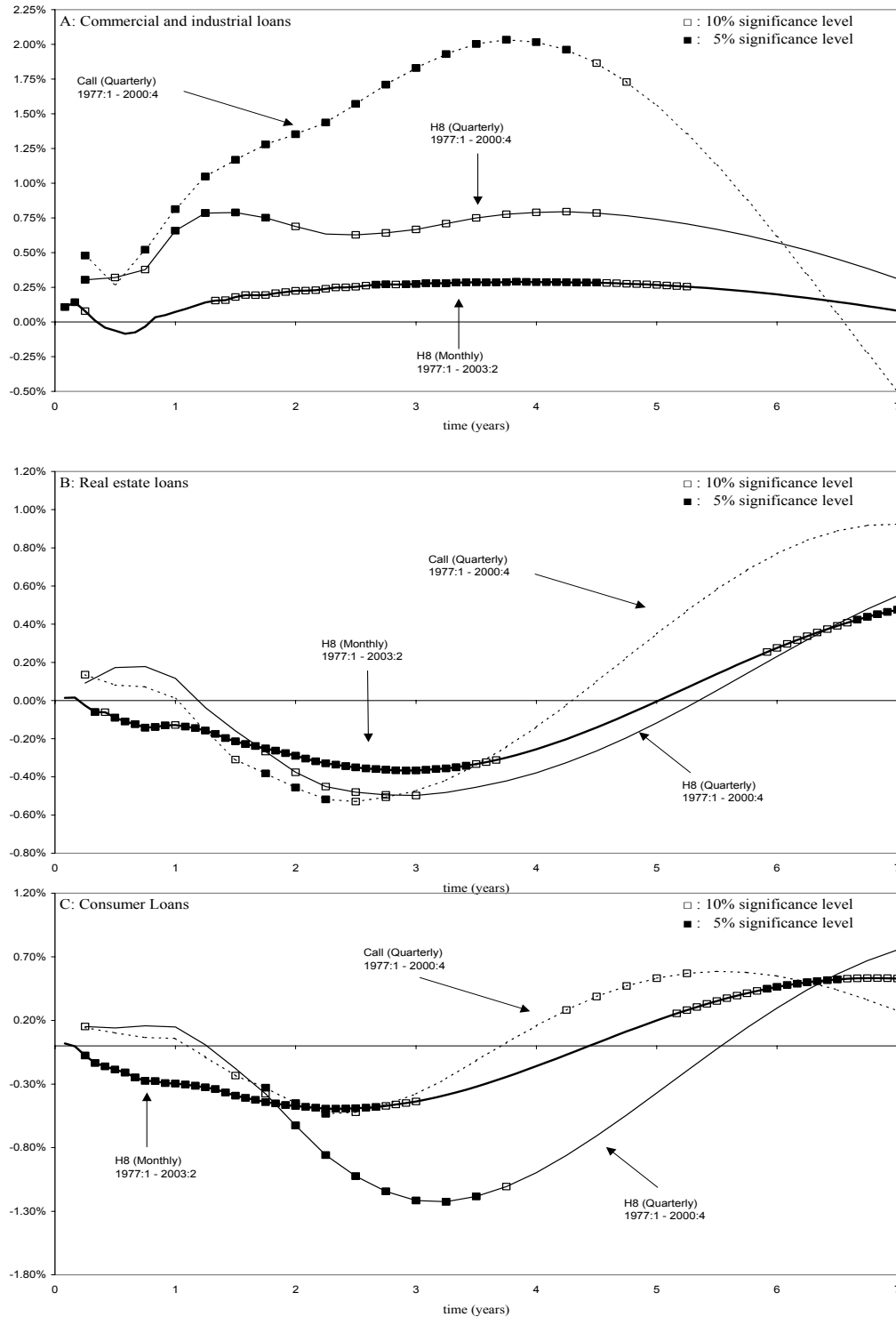
Note: These graphs plot the response of the indicated loan variable to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn. The curve labelled “non-monetary downturn” plots the time path of the loan variable following a sequence of output shocks that generates a time path for output that is identical to that of the monetary downturn. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests). The quarterly-H8 data set is identical to the quarterly-short-CALL data set except that the loan series from the Call Reports are replaced by the quarterly averages from the monthly-H8 data set.

Figure A.4: C&I loan impulse responses; CALL & H8 (domestically chartered banks) (1977:1 – 2000:4)



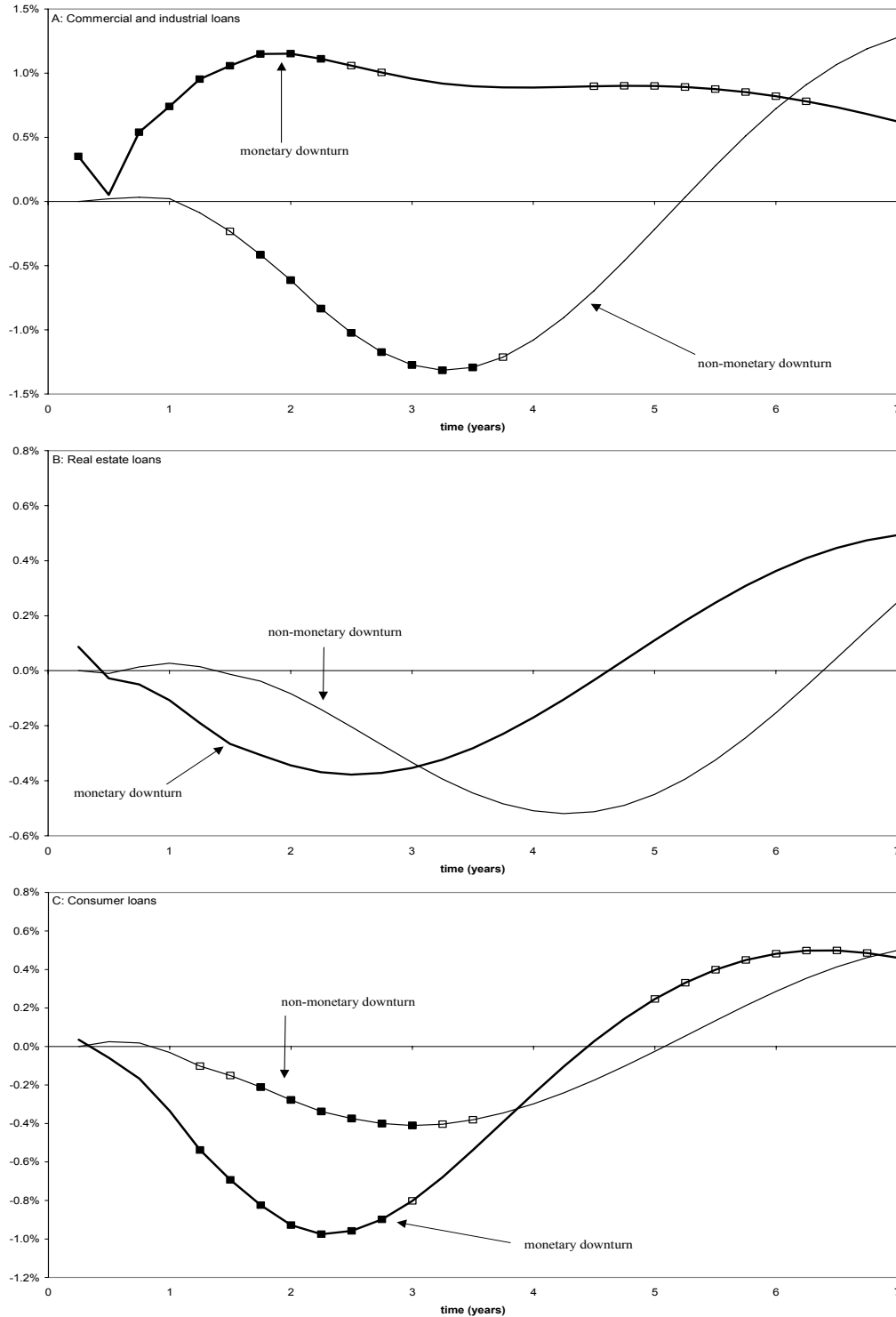
Note: This graph plots the response of C&I loans to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn, using the quarterly-short-CALL and the domestically-chartered series from the H8. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.5: Loans during a monetary downturn relative to a non-monetary downturn



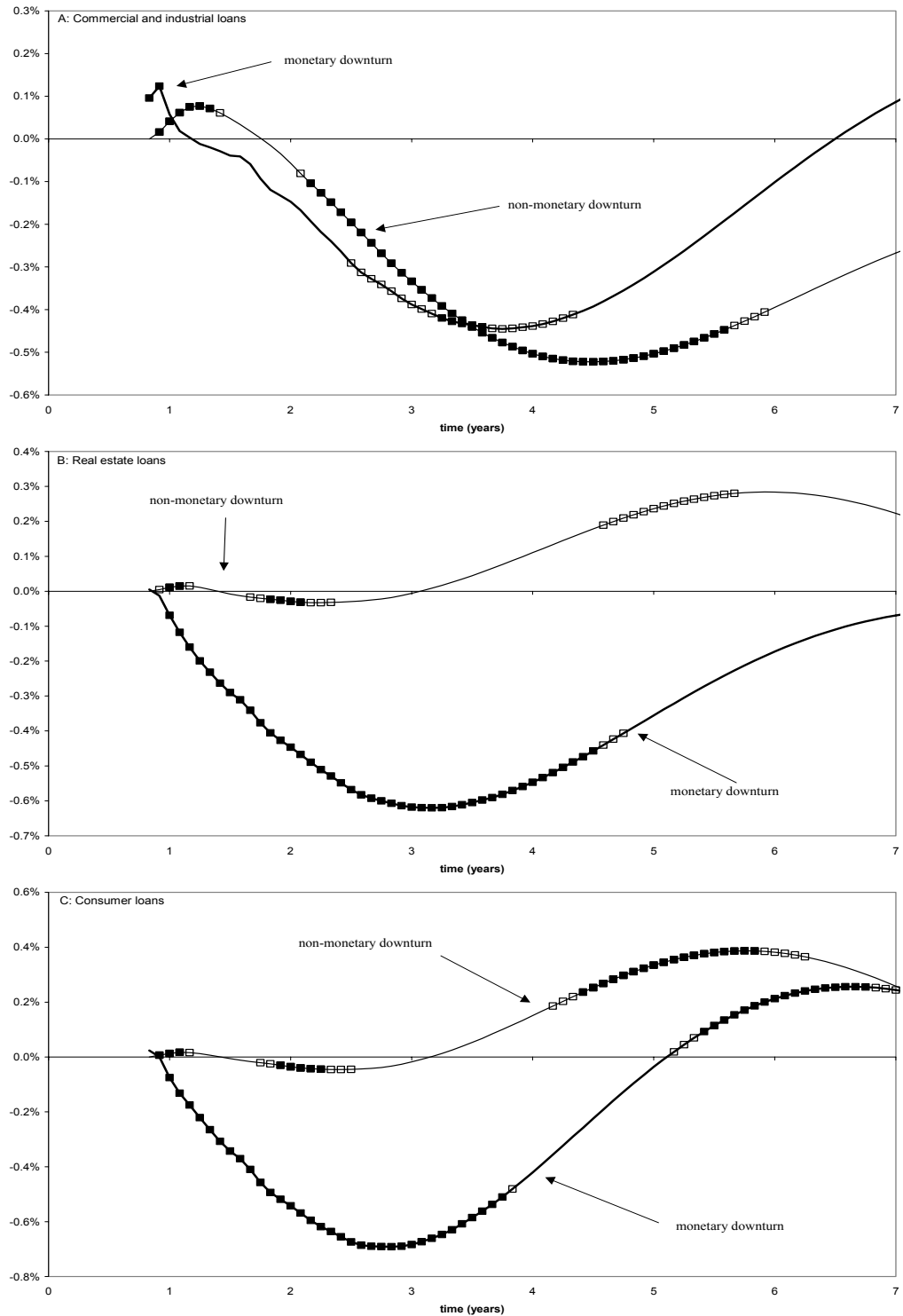
Note: These graphs plot the difference between the response of the indicated loan component during a monetary downturn and a non-monetary downturn of equal magnitude for the indicated variable and data set. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.6: Loan component impulse responses; BIC Specification
Quarterly-Short-CALL (1977:1 – 2000:4)



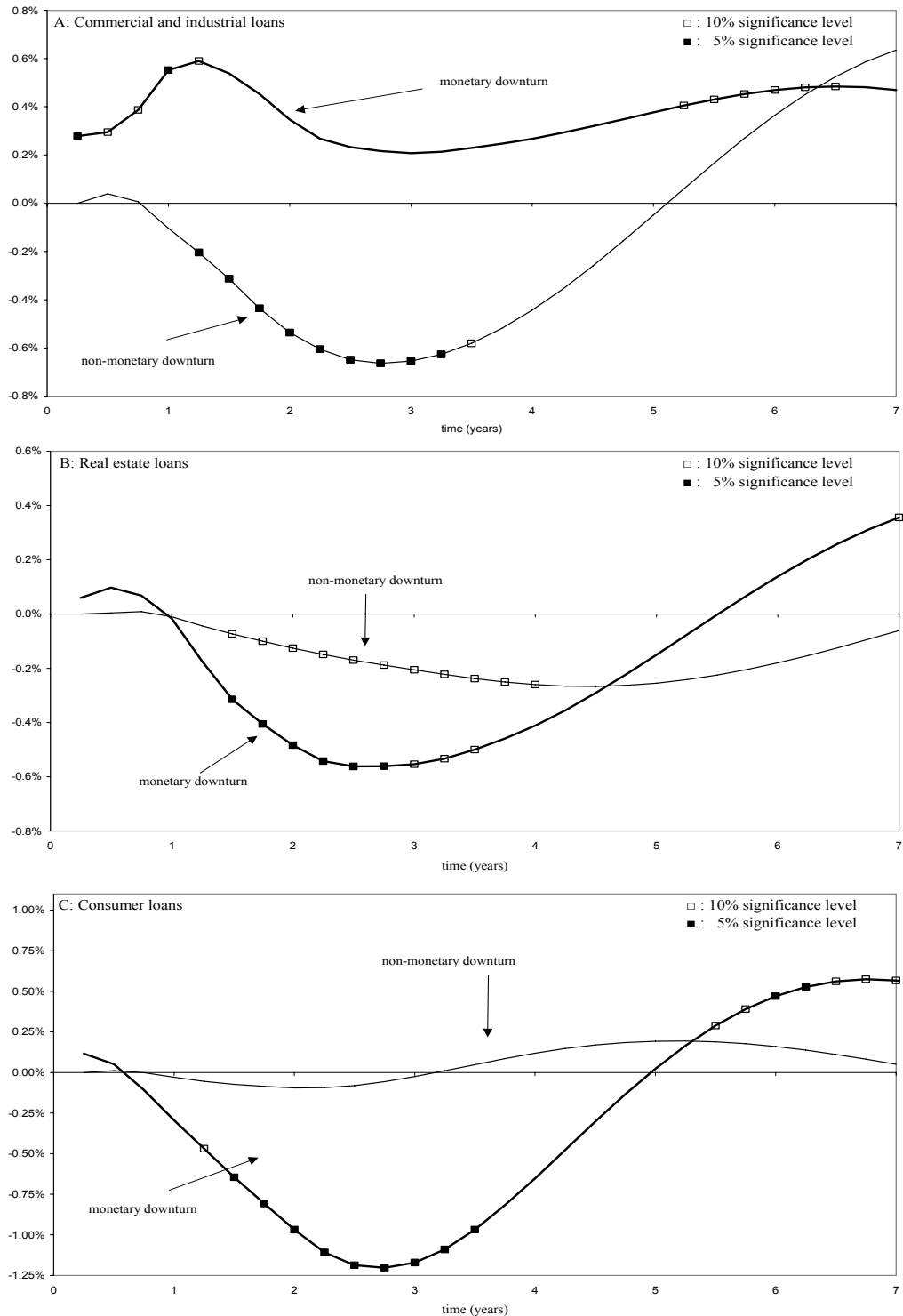
Note: These graphs plot the response of the indicated loan variable to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn. The curve labelled “non-monetary downturn” plots the time path of the loan variable following a sequence of output shocks that generates a time path for output that is identical to that of the monetary downturn plotted. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.7: Loan component impulse responses; BIC specification
Monthly-H8 (January 1960 – February 2003)



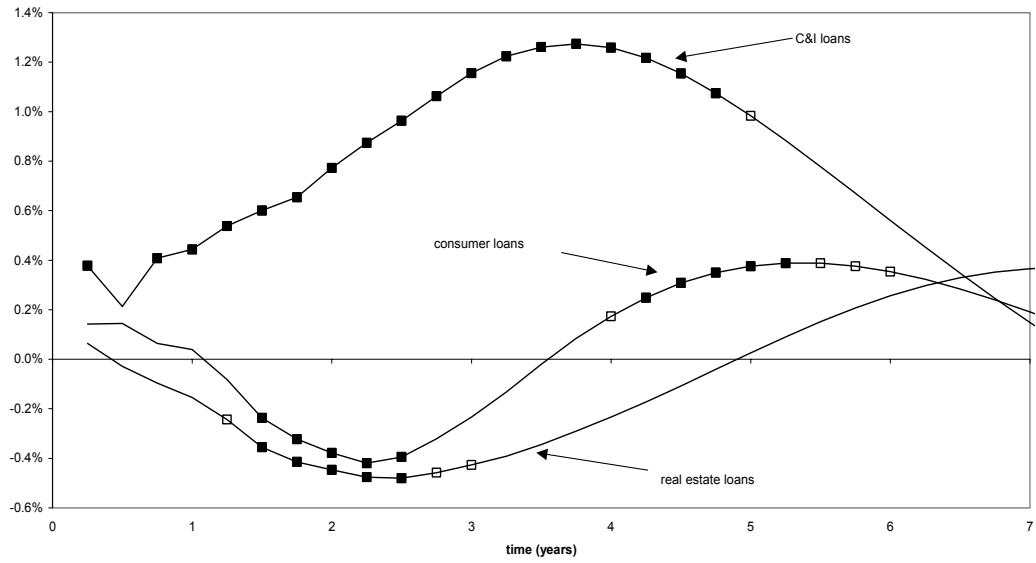
Note: These graphs plot the response of the indicated loan variable to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn. The curve labelled “non-monetary downturn” plots the time path of the loan variable following a sequence of output shocks that generates a time path for output that is identical to that of the monetary downturn. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.8: Loan component impulse responses; BIC specification
Quarterly-H8 (1977:1 – 2000:4)



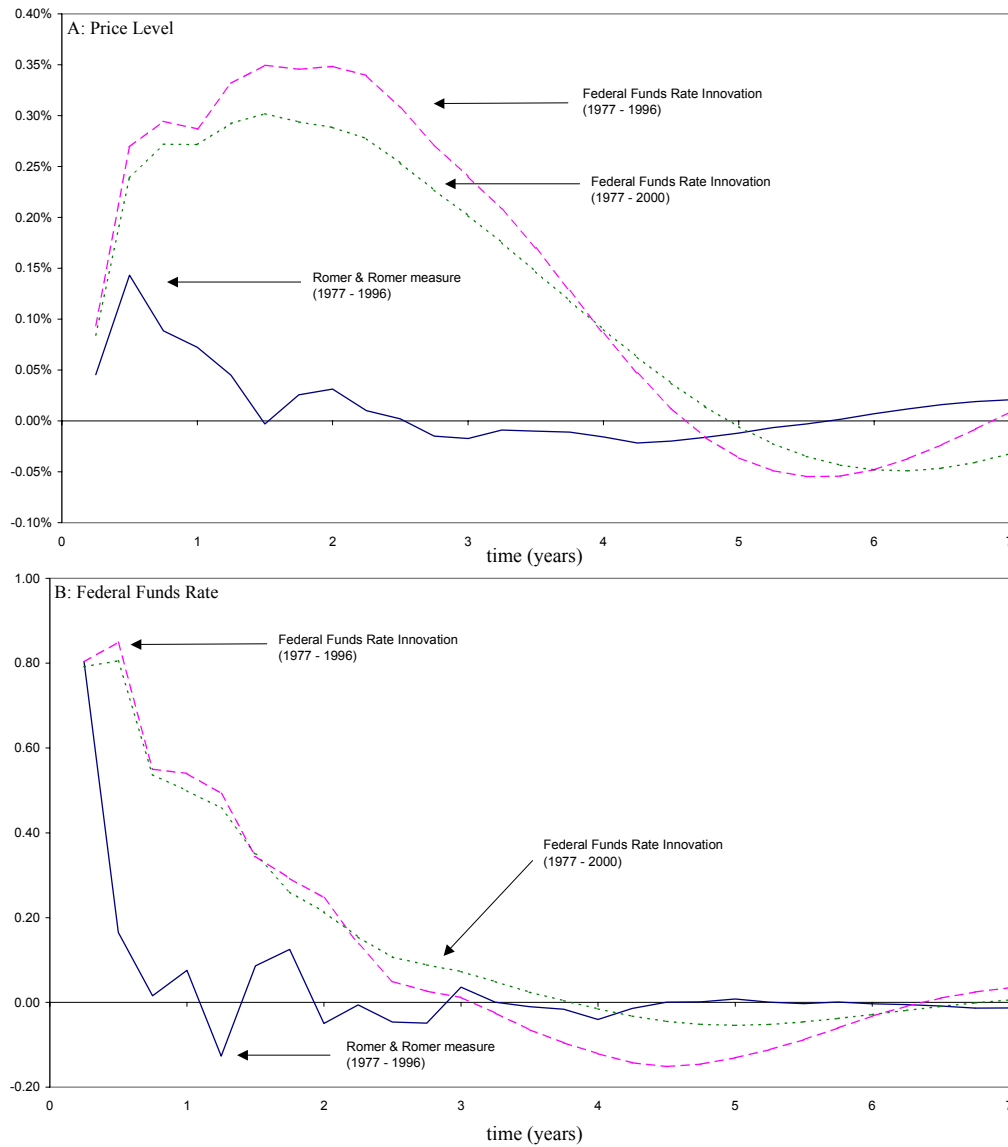
Note: These graphs plot the response of the indicated loan variable to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn. The curve labelled “non-monetary downturn” plots the time path of the loan variable following a sequence of output shocks that generates a time path for output that is identical to that of the monetary downturn. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests). The quarterly-H8 data set is identical to the quarterly-short-CALL data set except that the loan series from the Call Reports are replaced by the quarterly averages from the monthly-H8 data set.

Figure A.9: Differential loan component impulse responses; VAR with GDP and its Deflator Quarterly-Short-Call (1977:1 – 2000:4)



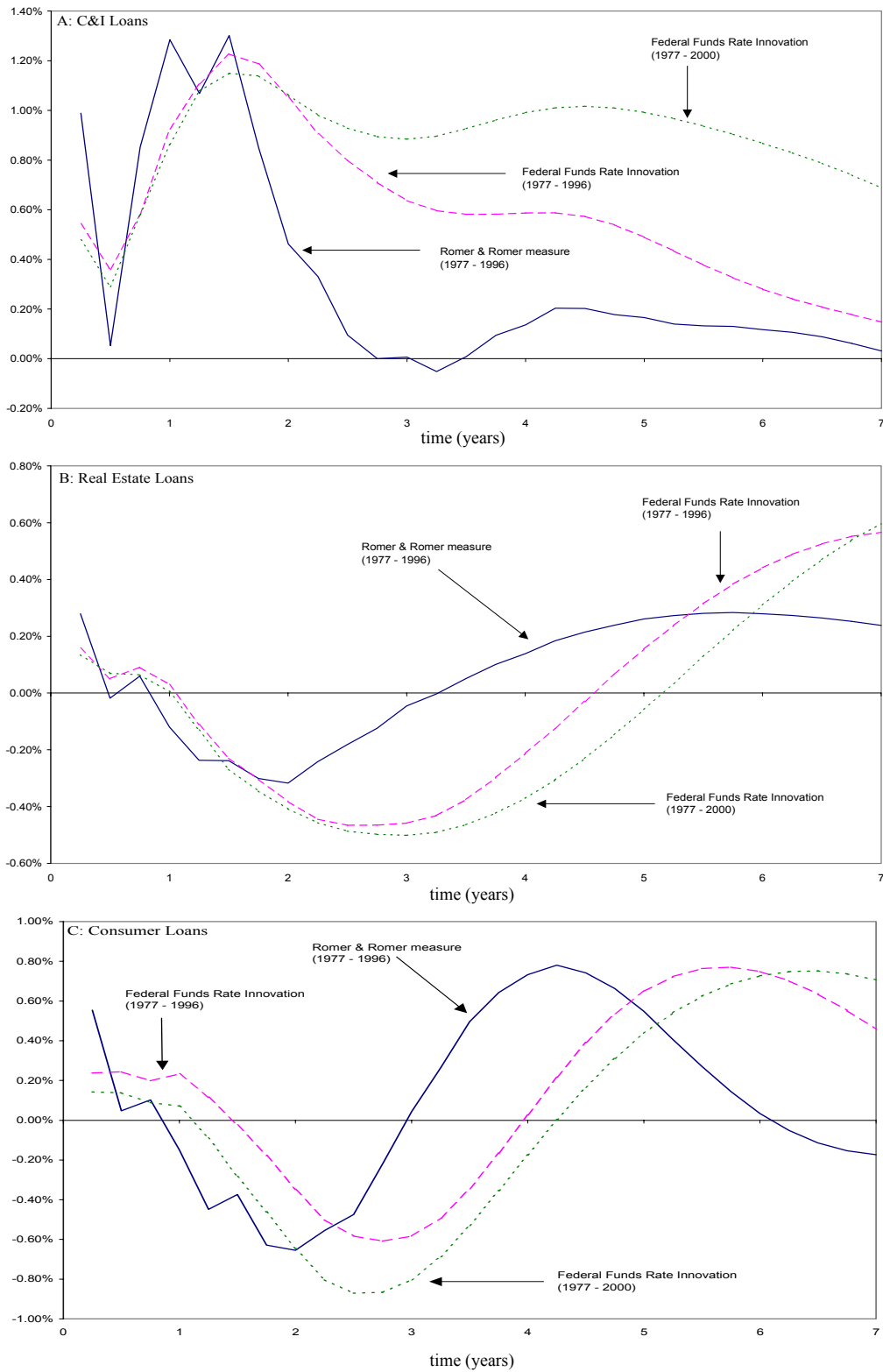
Note: This graph plots the difference between the response of the indicated loan component during a monetary downturn and a non-monetary downturn of equal magnitude for the indicated variable and data set. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.10: Response of the price level for alternative policy measures



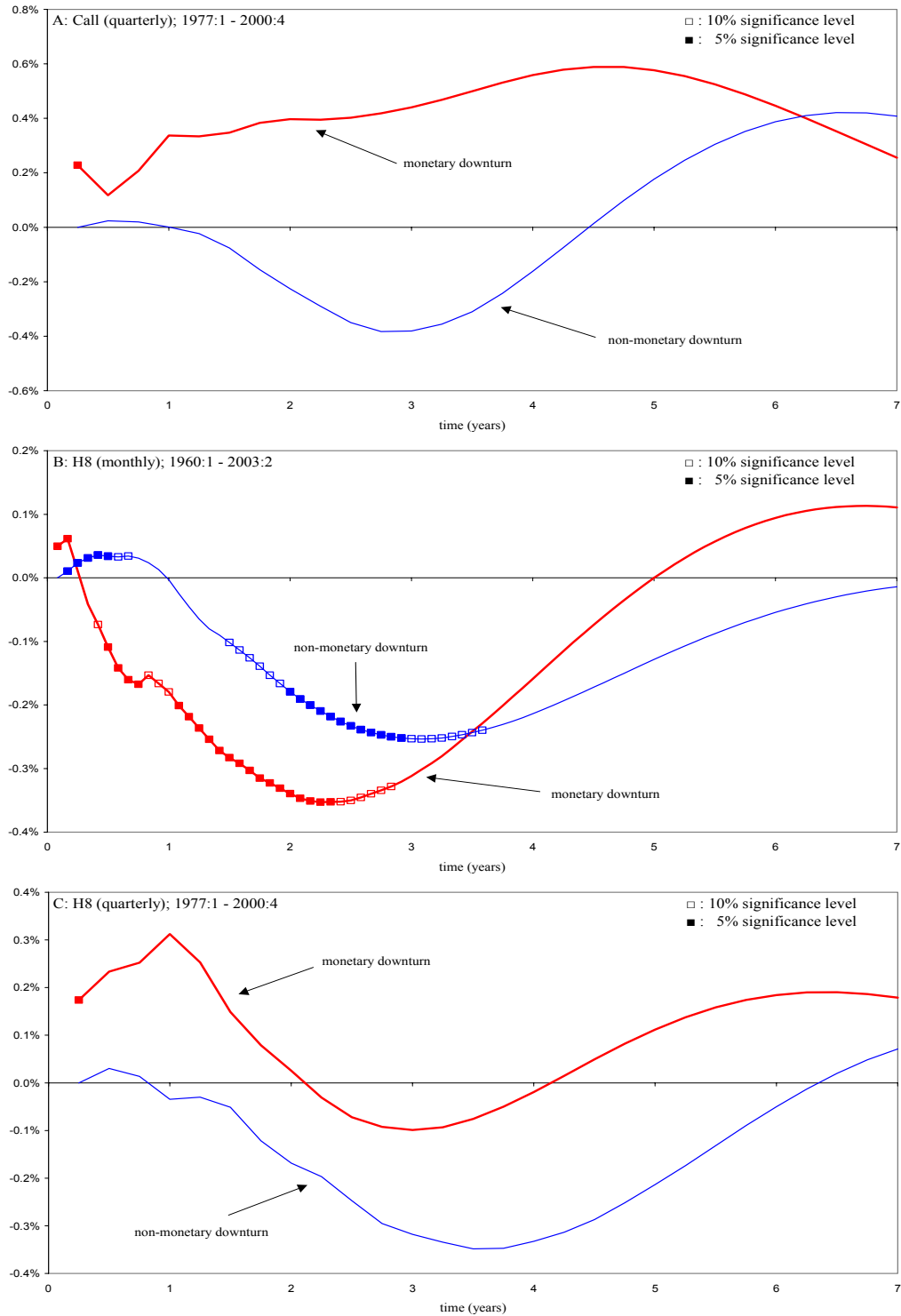
Note: These graphs plots the response of the indicated variable to a monetary tightening using either the Romer and Romer measure or a one-standard deviation shock to the federal funds rate. The VAR uses the benchmark specification and the quarterly-short-CALL data.

Figure A.11: Loan components responses for alternative policy measures



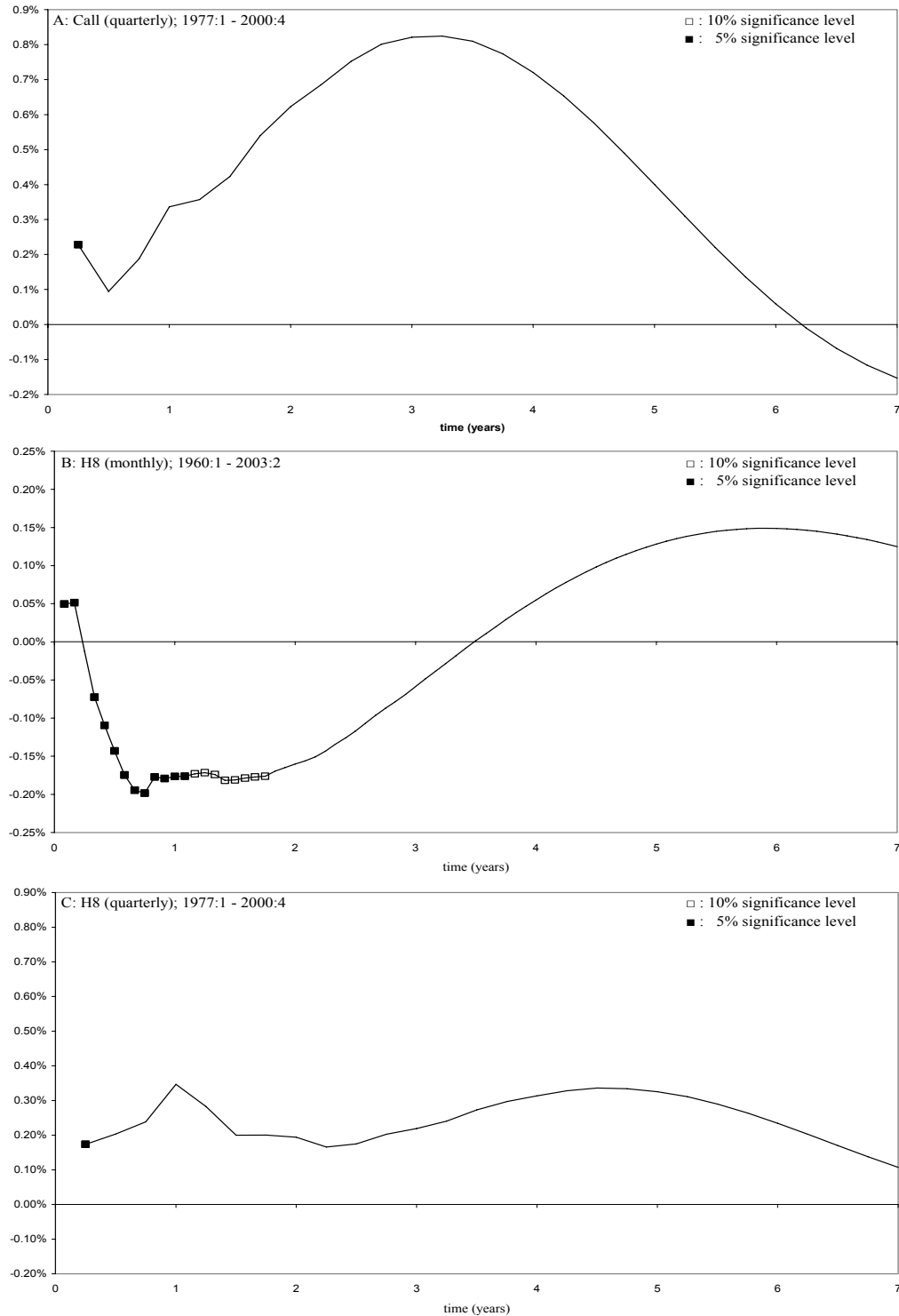
Note: These graphs plot the response of the indicated loan component to a monetary tightening using either the Romer and Romer measure or a one-standard deviation shock to the federal funds rate. The VAR uses the benchmark specification and the quarterly-short-CALL data.

Figure A.12: Total loans impulses for a VAR with no disaggregation into loan components



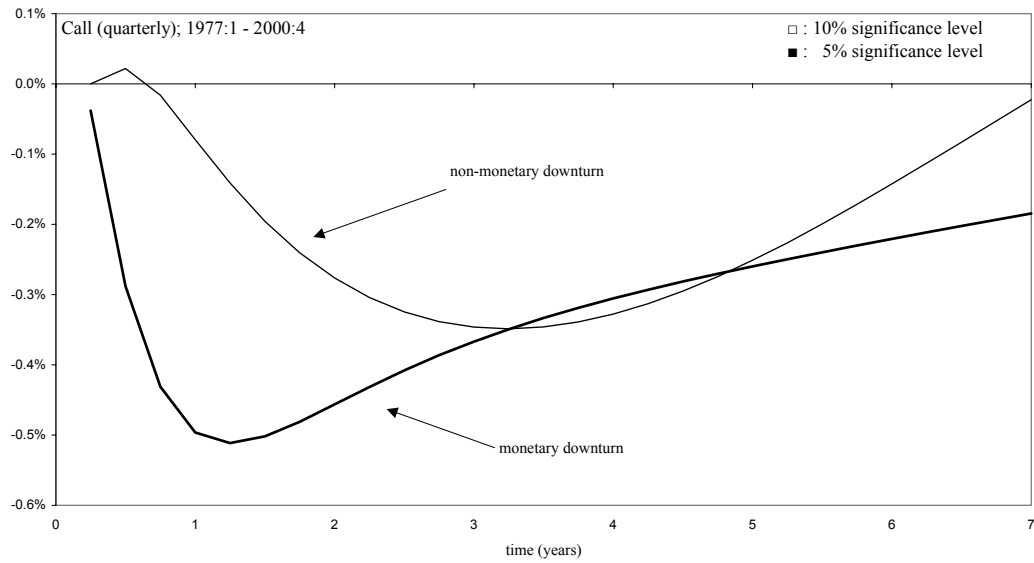
Note: These graphs plot the response of total loans to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn and the response to a sequence of output shocks that generates the same movements in output, i.e. a non-monetary downturn, for the indicated data set. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.13: Differential total loans impulses



Note: These graphs plot the difference between the response of total bank loans during a monetary downturn and a non-monetary downturn of equal magnitude for the indicated data set. The results are based on the benchmark specification. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Figure A.14: Total loans impulses for a VAR with no disaggregation into loan components (VAR with two quarters worth of lags, constant, linear trend, and seasonal dummies)



Note: These graphs plot the response of total loans to a one-standard deviation shock to the federal funds rate, i.e., a monetary downturn and the response to a sequence of output shocks that generates the same movements in output, i.e. a non-monetary downturn, for the indicated data set. Open squares indicate a significant response at the 10% level and solid squares indicate a significant response at the 5% level (both one-sided tests).

Table A.1: VAR specifications chosen by BIC

Monthly H8	number of lags for						trend	dummies
	R	P	C&I	RE	CON	Y		
Federal funds rate (R)	12	3	3	3	3	3	L	-
Price level (P)	3	3	4	3	3	3	none	-
C&I loans (C&I)	3	3	4	3	3	3	L	-
Real estate loans (RE)	3	3	3	4	3	3	none	-
Consumer loans (CON)	3	3	3	3	5	3	L&Q	-
Real activity (Y)	3	3	3	3	3	3	none	-
Quarterly H8								
Federal funds rate (R)	2	3	2	2	3	2	none	-
Price level (P)	2	4	2	2	2	2	none	-
C&I loans (C&I)	2	4	3	3	2	2	none	-
Real estate loans (RE)	2	4	3	2	2	2	none	-
Consumer loans (CON)	2	2	2	4	2	2	none	-
Real activity (Y)	2	2	3	2	2	2	L	-
Quarterly Short Call								
Federal funds rate (R)	2	3	2	2	2	2	none	0
Price level (P)	2	2	2	2	3	2	none	2 nd
C&I loans (C&I)	2	2	3	2	2	2	none	3 rd
Real estate loans (RE)	2	2	2	2	2	2	L&Q	1 st
Consumer loans (CON)	2	2	2	4	2	2	none	1 st
Real activity (Y)	2	2	4	2	2	2	L	0

Note: In the trend column, "L" indicates a linear trend is chosen and "L&Q" indicates both a linear and a quadratic trend are chosen. In the dummies column, the quarter of the chosen dummy is indicated. Note that the procedure allows for multiple dummies but at most one is chosen. The H8 data is adjusted for seasonality so we do not allow dummies to enter the specification