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ABSTRACT

The market for high yield (below investment-grade) corporate bonds developed in the middle 1980s. We show that, since this time, the high yield spread has had significant explanatory power for the business cycle. We interpret this finding as possibly symptomatic of financial factors at work in the business cycle, along the lines suggested by the financial accelerator. We also show that over this period the high yield spread outperforms other leading financial indicators, including the term spread, the paper-bill spread and the Federal Funds rate. We conjecture that changes in the conduct of monetary policy over time may account for the reduced informativeness of these alternative indicators, all of which are tied closely to monetary policy.

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1 Introduction

Until the early 1980s only the highest quality firms could issue marketable debt. By the middle 1980s, however, a market emerged for corporate bonds with below investment grade ratings. Firms that traditionally did not have the financial strength to float marketable bonds were now able to do so. The types of debt instruments they now issue are kindly known as "high yield bonds" (and unkindly known as "junk bonds.")[1]

In this paper we explore the information content that the spread between the high yield bond rate and the corresponding safe interest rate has for business cycle activity. Our motives are two-fold. First, as we discuss later, this spread may be a potentially good measure of overall financial conditions. In this respect, it may offer a way to detect evidence of the role of credit market frictions in the amplification and propagation of business cycles, along the lines suggested by the recent theoretical work on the financial accelerator[2].

Second, from both a forecasting and policy standpoint, there is on-going interest in exploring the information content of financial indicators.[3] These variables are well measured and available in real time. Some standard indicators which have performed well through the middle 1980s, particularly the commercial paper/T-bill spread and the term spread, appear to have lost considerable forecasting power in recent years.[4] The same has been true for simple indicators of monetary policy, such as the Federal Funds rate. In this context, it is interesting to explore the forecasting performance of the high yield spread as compared to these other indicators. To be sure, as we discuss below, we are skeptical of the value of heavy reliance on any single indicator. On the other hand, if the caveats are clearly understood, a financial indicator can have a potentially useful role in a policy-maker's information set. At a minimum, further, the kinds of forecasting exercises we undertake here can yield insights into the nature of the business cycle and (as we discuss) the role that monetary policy has played.

To help interpret the empirical work that follows, Section 2 outlines the theory of the financial accelerator. We argue that the relevant measure of financial conditions that the theory suggests is the premium for external funds, i.e., the spread between the cost of obtaining external finance and the opportunity cost of internal finance. We then argue that the high yield bond spread may provide a reasonable measure of this premium.

Section 3 explores the marginal explanatory power of the high yield bond spread for cyclical activity. The measure of the cycle we use is the log difference between real gross domestic output and the Congressional Budget Office's measure of potential output. We show that since the middle 1980s the high yield bond spread has had significant marginal explanatory power for the output gap, both statistically and quantitatively. We next show in section 4 that over this period, the explanatory power of the high yield bond spread

[1] For descriptions of the high yield bond market see Helwege and Kleiman (1997) and Milken (1999).

[2] Bernanke and Gertler (1989) describe the financial accelerator. For a recent survey of the literature, see Bernanke, Gertler and Gilchrist (1998.)

[3] See, for example, Estrella and Mishkin (1998).

[4] See Dotsey (1999) on the recent performance of the term spread and Friedman and Kuttner (1998) on the recent performance of the paper-bill spread.

dominates that of the two currently popular indicators, the term spread and the commercial paper/ T-bill spread. We base our conclusions on both an analysis of in-sample fit and of out-of-sample forecasts. We conclude that the results are suggestive of both the strong role that financial factors have played in recent times and also of the change in the role that monetary policy played in the most recent recession, as compared to previous downturns.

Section 5 examines the explanatory power of the high yield bond spread relative to some leading candidate driving forces of the economy, including oil shocks and monetary policy shocks. Again, the high yield bond spread appears to have superior explanatory power, both from a statistical and quantitative standpoint. One interesting side result is that, beginning in the early 1980s, the impact of monetary policy shocks on real GDP seems to vanish. We interpret this finding as corroborative of our argument in Section 3 that the traditional financial indicators (the term spread and the commercial paper/T-bill spread) may have suffered a reduction in explanatory power due to a recent change in the role that monetary policy plays in the business cycle. Section 6 contains some concluding remarks about how to interpret our overall findings.

2 The Financial Accelerator and the Premium for External Funds: A Guide for Interpreting Cyclical Movements in the High Yield Bond Spread

The banking and corporate debt crises experienced by a number of industrialized countries from the late 1980s to the early 1990s along with the more severe versions that have occurred in Japan and many emerging market economies have reawakened economists to the idea that financial market conditions may play an important role in shaping aggregate economic activity. At the same time, over the last decade, theoretical macroeconomic frameworks have evolved that characterize explicitly how financial factors may amplify and propagate business cycles. This mechanism is known as the "financial accelerator." More recently, models that feature a financial accelerator have developed to the point where they are now useful for providing a quantitative assessment of how much this mechanism might contribute to explaining aggregate fluctuations.[5]

While macroeconomics models that emphasize a financial accelerator often differ in details, they also contain several common elements[6]: First, there is some friction present in the financial market (e.g., asymmetric information or costs of contract enforcement) that introduces a wedge between the cost of external funds and the opportunity cost of internal funds, termed "the premium for external funds." Second, this premium is an endogenous

[5] See Bernanke, Gertler and Gilchrist (1998) and the references therein.

[6] See Bernanke and Gertler (1989) and Bernanke, Gertler and Gilchrist (forthcoming) for a formal derivation of the financial accelerator. The latter use a dynamic New Keynesian model as the baseline macroeconomic framework. One could also obtain qualitatively similar results using the larger scale model developed by Muellbauer (1996).

variable and depends inversely on the balance sheet strength of the borrower. Finally, borrowers' financial positions depend positively on aggregate economic activity (e.g. in a boom, asset values and cash flows rise relative to debt, and vice-versa in a downturn). The procyclical behavior in borrowers' financial positions in turn implies countercyclical movement in the premium for external funds. This countercyclical movement in the premium serves to amplify borrower spending and hence overall aggregate activity, relative to the case of frictionless financial markets. It is in this general way that the financial accelerator works.

The econometric evidence in support of the financial accelerator consists mainly of numerous panel data studies that demonstrate that liquidity constraints impinge on the behavior of both firms and consumers at the individual level[7]. Though not without controversy, these studies point to considerable evidence that financial market frictions matter at the individual level (i.e. that a premium for external finance exists and has on operative effects on real economic decisions). At the same time, direct empirical evidence of the importance of financial accelerator at the aggregate level has been harder to detect.

In addition to the usual problem of endogeneity that hampers any evaluation of aggregate data, there is the additional complication that the central economic variable at the core of the cyclical mechanism that these theories stress - the premium for external funds - is not easy to observe. More precisely, as we argue, until the development of the market for high yield debt, plausible indicators of this premium did not exist.

Ideally, one would like an indicator of the premium that is market determined. The problem here, as we have noted, is that until the early 1980s only the highest quality borrowers (specifically, investment grade firms) have been able to issue market debt. These types of firms experience relatively few obstacles in obtaining external finance. Hence, the spread they pay (relative to safe debt) is not going to help detect an operative financial accelerator. Firms that face the kind of financial market frictions that the theory describes have traditionally relied heavily on commercial banks for external finance. However, the only available bank rate (for use in aggregate time series analysis) is the prime lending rate. The latter, unfortunately is a posted rate. An additional complication is that bank loans often contain non-price terms that are not directly quantifiable. Thus, even if the prime were a market rate, it would still not accurately reveal the premium for external finance.

The development of the market for below investment grade debt has, among other things, opened up the possibility of obtaining a plausible measure of the premium for external finance. The rate on high yield bonds is clearly market determined. Further, the firms that obtain funds in this market are precisely the kind that face the type of frictions in the credit market that the theory describes. It is true that these firms reflect only a portion of those with imperfect access to credit. The rest obtain funds from commercial banks and other types of intermediaries. However, it is likely to be the case that over the cycle, the spread on high yield debt is closely correlated with the premium on external funds that these purely bank-dependent firms face. In this respect, the spread on high yield bonds might provide a good overall indicator of the external finance premium for the broad class

[7]For a recent survey of the literature see Hubbard (1998).

of firms with imperfect credit access.

To be clear, the spread could be a leading indicator even if capital markets were perfect, since it incorporates expectations of future default. However, the financial accelerator theory suggests that, everything else equal, the spread is likely to have greater marginal forecasting power for real activity than otherwise. The reason is that, under this theory, disturbances that orginate in the financial sector can affect the real economy, in contrast to the perfect markets paradigm. The high yield bond spread, in turn, is likely to incorporate these disturbances.[8]

In the next section, we explore the explanatory power of the high yield spread. The interpretation we give is that it provides a reasonable measure of financial conditions, as we have just outlined[9]. We also provide some evidence to support this interpretation.

3 The High Yield Bond Spread and the Output Gap: Empirical Analysis

Figure 1 presents plots of two candidate high yield bond spreads at the quarterly frequency over the period 1980:1 - 1999:1. The solid line is the difference between the high yield bond rate and the corresponding rate for the highest quality firms (AAA rated). The dotted line is the difference between the high yield rate and the rate on ten year Treasury Bonds. Overall both spreads move closely together. As it turns out, our empirical results do not depend on which spread we use.

We have a mild preference for the high yield/ AAA spread, for the following reason: The spread between the AAA rate and the ten year government bond rate can gyrate temporarily due to liquidity problems in the bond market. These gyrations, in turn, translates into shifts in the high yield/ government bond spread that are unrelated to the underlying quality of the firms in the market. This kind of phenomenon occurred recently during the default on Russian bonds. As Figure 1 illustrates, there was a sharp rise in the high yield/ government bond spread, but it was mainly due to an increase in the AAA/ten year government that came about as a result of the flight into government bonds. Because the firms in the corporate bond market had the option of obtaining short term bank loans to meet any funding needs, this "liquidity-induced" rise in corporate spreads had little impact on aggregate activity. The high yield/ AAA spread is largely immune to these transitory liquidity disruptions and is thus our preferred measure. We accordingly report results for

[8]Though we do not report the results here, a simple indicator of default risk for high grade borrowers, the BAA-AAA spread, has much less marginal forecasting power than the high yield bond spread. Thus, the possibility that the high yield bond spread is more sensitive to overall financial conditions (since it involves the market for below investment grade firms) might account for its greater marginal forecasting power, along the lines we have suggested.

[9]Mishkin (1991) early on advocated the use of a market determined interest rate spread to gauge financial market conditions. Bernanke and Gertler (1995) similarly argue in favor of a spread that could proxy the premium for external finance. They also provide a critique of the use of credit aggregates to proxy financial conditions.

this measure, though it is fair to say that the results change little when we use the other measure.

Note also that until the mid-1980s most of the outstanding high yield debt consisted of bonds that were initially investment grade but received a downgrade in rating during the 1980-82 recessionary period.[10] Beginning in the middle 1980s, however, most of the debt in the market was issued originally by below investment grade firms. For this reason we focus on a sample period that begins in 1985:1, though we also present results for the whole sample.

As Figure 1 shows, both spreads rise sharply in anticipation of the 1990-92 downturn. In addition, the spreads are lower in the recent period of robust growth (middle to late 1990s) than in the mid-1980s period of more modest growth. The informal picture then is that there is a strong inverse relation between the high yield spread and aggregate activity, at least since the mid-1980s. Even in the early 1980s, when the high yield market was not well developed (and consisted mainly of firms near investment grade), there was an upward spike in the spread during the recession, though it was less dramatic than what occurred during 1989-92.

We next supplement this informal analysis with some formal statistics. Figure 2 reports the cross-correlation of the high yield spread with the output gap (the log difference of real GDP and the CBO measure of potential output), for both the 1985:1-1999:1 sample and the 1980:1-1999:1 sample.[11] The results suggest that since 1985 there has been a strong inverse relation between the high yield spread and the output gap. Further the high yield spread clearly leads movements in output by one to two years. The high yield spread six quarters lagged, for example, has a correlation of -0.8 with the current output gap. A similar pattern holds for the full sample, though not as pronounced as in the sub-sample.

To next ascertain the marginal information in the high yield bond spread, we regress the output gap on four lags of itself and four lags of the spread. We consider two different specifications. In the first, the dependent variable is the output gap one quarter ahead. In the second, it is the output gap one year ahead. The former specification allows us to consider the information content in the spread for near term cyclical behavior while the latter allows us to consider the information content for the medium term.

Table 1 presents the results for each specification over the two sample periods. Reported are (i) exclusion tests of the null hypothesis that the high yield spread contains no marginal information and (ii) the sum of the coefficients on the high yield spread along with tests of the null that this sum is zero. Over the 1985:1-1999:1 sample, we strongly reject the null hypotheses that the spread contains no marginal information for both the quarter ahead and year ahead specification. The sum of the coefficients are negative and statistically different from zero, so that the spread not only predicts but predicts in the direction we would expect: i.e., controlling for the lagged output gap, a rise in the spread signals a decline in the future output gap. Similar results appear for the year ahead specification over the full sample. The spread is not significant in the quarter ahead case, however. Thus, the strong relation

[10] These downgraded bonds are known in the market as "fallen angels."

[11] Note that both the output gap and the high yield spread are stationary random variables.

between the spread and cyclical activity really begins in the middle 1980s, as the earlier descriptive analysis suggests.[12]

To gauge whether movements in the spread matter quantitatively for movements in the output gap, we estimate a simple bivariate vector autoregression (VAR). We use four lags of each variable and order the spread last (i.e. we assume that movements in the output gap may have a contemporaneous impact on the spread but not vice-versa.). Figure 3 reports the effect of a one standard deviation increase in the yield spread. The error bands represent two standard deviation confidence intervals. As the figure shows, an unanticipated one standard deviation rise in the spread leads to a significant decline in output, both statistically and economically.

The interpretation we wish to give to the link between movements in the spread and the output gap is that it is symptomatic of the financial accelerator at work. To be sure, since the evidence is based on a reduced form system, the impulse response does not yield any kind of precise quantitative estimate of this mechanism. What it does say is that some kind of shock that is orthogonal to the current output gap and manifests itself in an increase in the high yield spread does have a significant effect on the path of aggregate real activity. Thus while the evidence is not definite proof of a quantitatively important financial accelerator, it is certainly compatible with this scenario.

Figure 4 presents some further descriptive evidence in support of the notion that an operative financial accelerator underlies the co-movement between the high yield spread and the output gap. The top panel shows that movements in the high yield spread are closely related to the net interest burden that non-financial corporations face. The latter is the ratio of interest payments to interest plus cash flow. It is a simple (inverse) measure of firms' balance sheet strength. As we noted, the theory underlying the financial accelerator suggests an inverse relation between balance sheet strength and the premium for external funds. The co-movement between the high yield spread and the net interest burden is consistent with this scenario.

Particularly striking is the simultaneous sharp rise in both variables during the late

[12] As we have noted, the salient feature of the data is the very sharp rise in the high yield spread in late 1989 that preceded the 1990-91 recession, the only significant dowturn in the sample. While it is perfectly legitimate to exploit the variation in the data that comes from this single epsiode, it is nonetheless useful to know whether this event accounts for all the explanatory power of the high yield spread for the output gap. To get at this issue, we re-estimated the forecasting equation for the output gap, this time allowing the coefficients to switch (at all lags) on the five observations on the spread between 1989Q:4 and 1990Q:4. In effect, we identify the explanatory the spread that remains after removing the five largest observations in the sample. Overall, the explanatory power of the high yield spread for the output gap a year ahead is largely unaffected by this exercise. In particular, for the year ahead regression, the p-value for the joint significance of the spread is 0.03 for the full sample and 0.00 for the restricted sample. Further, the sum of the coefficients (with p-values in parentheses) over the two samples are -0.007 (0.03) and -0.008 (0.00). Thus, little changes from the benchmark case reported in Figure 1. For the quarter ahead case, however, the high yield spread does not add significant marginal predictive power in the restricted sample. However, the sum of the coefficients remains significantly negative. In summary, the 1990-91 recession alone does not account for the explanatory power of the spread for the year ahead output gap, but does seem to matter a great deal for the quarter ahead case.

1980s. A combination of events contributed to the rise in the net interest burden over this period: (i) the development of the high yield bond market, (ii) tightening of monetary policy (i.e. increased short term interest rates) and (iii) a weakening of corporate cash flows due to the tightening and other factors. It is exactly this kind of scenario that should produce a rise in the premium for external funds that, in turn, has an overall dampening effect on the economy. The co-movement between the net interest burden, the high yield spread and the output gap are certainly consistent with this interpretation of events. It is also of interest to observe that during the recent period of high growth, the net interest burden is low and so too is the high yield spread. Again, the broad picture aligns with the notion of an operative financial accelerator.

The premium for external funds should also be related to conditions in banking. Weakness in bank balance sheets impedes the ability of these institutions to intermediate funds. The net effect is to constrain the overall supply of funds to firms with imperfect access to credit and thereby raise the premium for external funds. The bottom panel in Figure 4 compares the movement in the high yield spread to the condition of bank capital asset ratios from 1984:1 through 1999:1. The low capital asset ratio at the beginning of the period reflects the consequences of the risk-taking encouraged by the deregulation of the financial services industry that occurred in the late 1970s and early 1980s. This deregulation was not accompanied by a prudent adjustment of the (regulatory) financial safety net. As a consequence, many banks became highly levered and at the same time ventured into increasingly risky types of loans. The combination of poor capitalization and a risky loan portfolio left many of these institutions heavily exposed to the shocks that followed, including the defaults on LDC debt and the collapse of oil and real estate prices. The net effect was a serious decline in bank capitalization. Accompanying this decline in capital was a sharp rise in the high yield spread, in line with the theory of the financial accelerator.[13] Interestingly, the low spread that has prevailed in recent times is accompanied by strength in not only non-financial corporate balance sheets, but bank balance sheets as well.

Finally, the bottom panel also plots the information on the terms of bank lending from the senior loan officers' survey.[14] The gap from 1984 to 1990 reflects the fact that the survey was briefly discontinued over this period. However, the available data shows that periods where the terms of credit tightened are associated with upward movements in the high yield spread. In this respect the high yield spread appears to be a good measure of overall financial conditions as we conjectured.

[13]For a discussion of the problems in banking during the 1980s and the impact these problems had on the real economy, see Bernanke and Lown (1991).

[14]For a analysis of the forecasting value of the information in the loan officer's survey, see Lown, Morgan and Rohatgi (1999).

4 A Comparison with Other Spreads

In this section we compare the explanatory performance of the high yield spread to the two leading alternatives: the commercial paper/T-bill spread and the term spread (ten year government bond minus one year bond.) Each of these spreads has been a reliable indicator of economic activity for most of the time since the early 1970s, but each has declined in performance over the last decade.[15]

Traditional use of financial information for forecasting emphasized monetary aggregates, following the lead of Friedman and Schwartz (1963). As suggested by Goodhart's law, attempts to target monetary aggregates in the early 1980s led to a decline in their forecasting power. Financial innovation (which induced fluctuations in velocity) also caused the statistical relation between money and output to deteriorate.

In response to the poor predictive performance of monetary aggregates, Friedman and Kuttner (1992, 1993) originally proposed examining the predictive power of the paper-bill spread. They showed that this indicator had strong predictive power up through the mid-1980s. For similar reasons, Estrella and Hardouvelis (1991) and Estrella and Mishkin (1998) proposed the term spread. This variable also worked very well over a similar time period.

In our view, the performance of each of these indicators is tied closely to monetary policy. In particular, each of these spreads moves sharply in periods of significant monetary tightening. For example, during periods of sharp increases in the Federal Funds rate, the paper-bill spread has widened significantly and the term spread has become significantly negative (i.e, the yield curve has become inverted.) The widening of the paper-bill spread is associated with a surge in money market instruments, including commercial paper and CDs that has typically accompanied a monetary tightening: the surge of these instruments on the market temporarily depresses their price.[16] The negative movement in the term spread simply reflects that the monetary tightening is inducing a rise in near term short rates relative to future short term rates.

To the extent that these indicators are connected with monetary policy, then it is understandable why they might perform well through the middle 1980s. As a number of economist have noted, monetary tightening to curtail inflation was an important feature of each of the recessions from the late 1960s through the early 1980s. In this vein, since a sharp monetary tightening did not precede the most recent downturn (1990-92), it is understandable that these indicators did not forecast real activity to the same degree as in the past.

Figure 5 presents cross-correlations of each of these indicators with the output gap. To illustrate the change in the cyclical pattern of each of these indicators over time, we plot results for the two samples: 1980:1 - 1999:1 and 1985:1-1999:1. Note that the former includes the period of monetary policy tightening under Volcker. For the full sample, the

[15] See Stock and Watson (forthcoming) for a general description of the cyclical pattern of interest rate spreads.

[16] See Kashyap, Stein and Wilcox (1993), Friedman and Kuttner (1993) and Gertler (1993).

patterns are consistent with the idea that the indicators are capturing policy tightening. In particular, the current output gap is negatively correlated with lagged values of the paper-bill spread, implying that a rise in the spread (perhaps induced by a policy tightening) signals a subsequent decline in output. In a similar spirit, over the full sample, the output gap is positively correlated with lagged values of the term spread: Accordingly, a decline in the term spread (again, perhaps induced by a policy tightening) signals a decline in output.

Note, however, that for both indicators, the cross-correlation with the output gap changes dramatically when we move from the full sample to the sub-period 1985:1-1999:1. Again, the results are consistent with the interpretation that these indicators are tied to monetary policy. The absence of a monetary policy-induced contraction in output on the scale of the early Volcker disinflation appears to account for the breakdown in the lead-lag relation observed over the full sample.

We explore the issue further by considering some simple "horse races" of the high yield spread against each of the alternative spreads. In each case, we regress the output gap on four lags each of output gap, the high yield spread and one of the alternative indicators. We consider both quarter ahead and year ahead estimates. We also estimate over the 1980:1-1999:1 sample and the 1985:1-1999:1 sample.

Table 2 presents the results from exclusion tests of the high yield spread versus the alternative indicator. The numbers in the table are p-values for the null that the particular spread has no information for the output gap. Over the full sample (which, again, includes the Volcker disinflation) the term spread appears to dominate. It is a statistically significant predictor of the output gap after controlling for the high yield spread, for both quarter ahead and year ahead forecasts. The high yield spread in this case is significant only for the year ahead forecast. The paper-bill spread over this sample is significant only for the quarter ahead forecast. The reverse is true for the high yield spread in this case.

The results change, however, for the 1985:1-1996:1 sample. In this case, the high yield spread has more reliable marginal explanatory power for the output gap than either the paper-bill spread or the term spread. When run against either alternative indicator, the high yield spread remains a statistically significant predictor of the output gap. This result holds for both the quarter ahead and year ahead estimates of the output gap. Interestingly, the term spread has no significant marginal explanatory power for the output gap over this period. The paper-bill spread is significant for the year ahead forecast.

We explore the issue further by considering the ability of each spread to aid in out-of-sample forecasts for the output gap. Specifically, we consider a set of bivariate regressions of the output gap on four lags each of the output gap and the respective spread. For benchmark purposes, we also estimate a univariate relation of the output gap on four lags of itself. Again, we consider both quarter ahead and year ahead estimates of the output gap.

We first estimate the equation over the period 1985:1 through 1996:1 for the quarter ahead case, and stop a year earlier (1995:1) for the year ahead case. We next generate a forecast for each case (in the quarter ahead case the first forecast is for 1996:2 and in the year ahead case it is for 1996:1.) We then move forward one quarter, re-estimate the model (over the sample 1985:1 - 1996:2, for the quarter ahead case and 1985:1-1995:2 for the year

ahead case) and then generate a new set of forecasts. We continue this algorithm through the end of the sample.

Figure 6 presents the results for the quarter ahead forecasts and Figure 7 for the year ahead. The top panel in each figure plots the ex post behavior of GDP against the forecast from the univariate case. Note that in each instance the univariate model systematically underpredicts.

The bottom panel reports the out-of-sample results for each of the bivariate models. Interestingly, the high yield spread significantly improves both the quarter ahead and year ahead forecast of the output gap. The forecast in each case tightly overlaps the realized value. On the other hand, neither the paper-bill spread nor the term spread is particularly helpful for predicting the output gap over this period. As in the univariate case, the forecasts systematically underpredict the output gap.

From a variety of standpoints, accordingly, since the mid 1980s the high yield spread has been a more reliable indicator of cyclical activity than either the paper-bill spread or the term spread.

5 Oil Shocks and Monetary Policy

We next compare the marginal information in the high yield spread to several other variables that reflect potentially important forces that affect the economy: the real price of oil and several indicators of the stance of monetary policy. As in the previous section, we run a simple horse race of the high yield spread against an alternative, based on a projection of the output gap on lagged values of itself, the high yield spread and the alternative variable.

The first alternative we consider is the real price of oil. Hamilton (1983) and others have argued that oil shocks have been a central driving force of the business cycle. The question then arises as to whether the high yield spread might be capturing information about this shock. On the surface this seems unlikely because the high yield spread rose well in advance of the 1990 oil shock associated with the war in Kuwait (see Figure 1).[17]

Table 3 presents results that bear out this conjecture. The top two rows present results of exclusions tests for the high yield spread and the real price of oil respectively. As before, the number presented is the p-value for the null that the variable in question is not significant in the trivariate regression equation for the output gap. Over the full sample, 1980:1 -1999:1, the real oil price is significant and the high yield spread is not. Note that this sample captures the influence of not only the 1990 oil shock on output, but the 1979 shock as well. It also includes the period 1980:1-1985:1 where the high yield bond market was not well developed.

The results change, however, when we restrict attention to the 1985:1 -1999:1 period. The high yield spread is now significant, and strongly significant for the year ahead forecast. Oil prices are only marginally significant for the year ahead forecast of the output gap.

[17] One qualification is that the high yield market may have anticipated the problems in Kuwait. Investigating this issue is beyond the scope of the paper.

Thus movements in the high yield spread over this period contain significant information for output that is independent of movements in oil prices.

It is important to note that even if oil prices had eliminated the explanatory power of the high yield spread, it is still the case that a financial accelerator mechanism could have been at work over this period. The triggering force in this case would have been the oil shock. That is, to the extent that rising oil prices weakened firm financial positions, the financial accelerator could have served to magnify the direct affect of oil prices on real activity. However, since oil prices do not eliminate the explanatory power of the high yield spread, we are left with the possibility that disturbances other than oil shocks may have triggered the financial accelerator.

We next turn attention to indicators of monetary policy. We consider two: the broad aggregate M2 (specifically, the growth rate) and the Federal Funds rate, as proposed originally by Bernanke and Blinder (1992). Endogeneity problems make M2 a questionable indicator of the stance of policy. We nonetheless include it, given the tradition of analyzing the predictive power of this aggregate (not to mention the interest of the new European Central Bank in monetary aggregates). One issue is that in the simple trivariate regressions we are not controlling for inflation. Thus, in addition to the nominal growth rate of M2 and the nominal Funds rate, we also consider real M2 growth and the ex post real Federal Funds rate.

As Table 3 shows, the monetary indicators tend to do better over the full sample 1980:1-1999:1 than over the restricted sample that begins in 1985:1. The high yield bond spread dominates M2 over each period. As we have noted, however, M2 is a questionable indicator of the stance of monetary policy.

The Federal Funds rate, on the other hand is highly significant over the full sample. In this case, the high yield spread is significant only for the year ahead forecast. However, the situation more than reverses when we restrict attention to the 1985:1-1999:1 sub-period. Here the high yield spread is significant for both the quarter ahead and year ahead forecast of output. The Funds rate, on the other hand is insignificant in both cases.

Overall, the results are consistent with those obtained in the previous section, to the extent that the paper-bill spread and the term spread are closely tied to the stance of monetary policy. That is, the Federal Funds rate has highly significant marginal information only when we include the period of the Volcker policy tightening, as was the case with the paper-bill and term spreads.

It should be clear that the results do not suggest that monetary policy has become unimportant in recent years. Rather they imply only that the "non-systematic" movements in policy have become less important, so that the marginal information for aggregate activity contained in indicators tied closely to monetary policy has diminished.[18] The same, however, is not true for the high yield spread, which seems to contain significant information for the output gap that is not available from the lagged output or other leading indicators.

To explore this issue further, we consider the effects of orthogonalized shocks to the

[18]See Bernanke, Gerter, and Watson (1997) for an analysis of the problem of identifying the systematic versus non-systematic component of monetary policy.

Funds rate versus the high yield spread. We begin by noting the change in the impact of the Funds after the early 1980s. In particular, we consider a simple quarterly VAR that includes four lags of the Federal Funds rate along with the logs of real GDP, the real GDP deflator, and an index of commodity prices. This kind of system is the simplest that has been used to analyze the impact of monetary policy shocks.[19]

To identify a shock to monetary policy, we order the Funds rate last in the VAR. Figure 8 then portrays the impulse responses to a positive shock to the Funds rate, for the two samples 1979:4-1999:1 and 1985:1-1999:1. Over the long sample, the unanticipated rise in the Funds rate has the conventional effect: Output and prices decline; and the effect is statistically significant. However, when we restrict attention to the shorter sample, the impact of the Funds rate completely vanishes[20]. Again, we stress that this does not imply that monetary policy has become unimportant, only that the non-systematic component has become less significant. The longer sample incorporates the Volcker disinflation during which there was an unusual rise in the Funds rate. The simple linear model interprets this period as one of big positive shocks to the Funds rate, which helps account for the overall impact of the orthogonalized shocks.[21] The absence of high inflation post-1985 eliminated the need for any unusual tightening. In addition, as originally emphasized by Taylor (1993), monetary policy under Greenspan has reacted in a very systematic way to the economy. As a consequence it is only natural that monetary policy shocks should have become less important.

Finally, we add the high yield bond spread to the VAR and order it last in the system. Thus, we let monetary policy affect the spread within the period, but assume that the Fed is not influenced by current innovations in the spread - though, it may certainly be influenced by lagged movements in the spread. We then consider the impact of a positive shock to the yield spread. Note that the shock has a significant depressing effect on real output over time. Thus, movements in the spread over this period that are orthogonal to output, prices and the Funds rate have a significant impact on aggregate activity. Again, the results are consistent with there being an operative financial accelerator during this era.

6 Conclusion

Our results indicate that the high yield bond spread contains statistically significant and quantitatively important information for aggregate economic activity since the time of the

[19] See Christiano, Eichenbaum and Evans (1996) and Bernanke and Mihov (1998). The authors also include non-borrowed and total bank reserves in the model. Under the assumption that the Funds rate is the policy instrument, however, adding reserves typically has little impact on model dynamics.

[20] Note that the results pertain to quarterly data. With monthly data it is possible to detect a significant effect of the Funds rate on industrial production, post-1985. However, the results typically are accompanied by a "price puzzle" (i.e, a policy contraction produces a rise in prices), which makes questionable whether the policy shock is properly identified.

[21] Clarida, Gali and Gertler (forthcoming) provide formal evidence of a significant shift in the reaction functon around the time of Volcker.

development of the market for below-investment grade debt. This conclusion is based on an analysis of both in-sample fit and out-of-sample forecasts. One caveat is that the sample period (1985:1-1999:1) is relatively short and includes only one major recession.[22] On the other hand, the high yield spread does considerably improve the out-of-sample forecast of the recent behavior of the output gap, particularly relative to other financial indicators.

We also argue that the high yield spread may be a good measure of overall financial conditions. In particular, it may be good proxy for the premium for external funds, a variable that plays a central role in the financial accelerator. In this vein, the cyclical relation between the high yield spread and the output gap may be symptomatic of an operative financial accelerator, along the lines suggested by the theory.

Another key finding is that, since the middle 1985s, the high yield spread outperforms the other leading financial indicators of real economic activity, including the paper-bill spread, the term spread and the Federal Funds rate. As we discussed, changes in the conduct of monetary policy that have occurred since the early 1980s likely account for the reduced informativeness of these alternative indicators, all of which are closely tied to monetary policy.

A virtue of the high yield spread is that because it is extremely sensitive to default risk, it may detect a greater variety of factors that influence the macro-economy than do the other indicators. This might explain why it was informative, in contrast to the other indicators, over an era where monetary policy was not the central factor in the downturn.

Thus, there is the possibility that the high yield spread may prove to be a relatively durable and useful indicator of economic activity. Several qualifications are in order, however: First, it is important to keep in mind that the informativeness of any financial indicator is sensitive to the nature of the business cycle and, relatedly, to the conduct of monetary policy. Attempts to adjust policy to target the indicator will reduce its informativeness, as we know from Goodhart's law. In a similar spirit, because the cyclical properties of the indicator are likely sensitive to the monetary policy rule, basing policy explicitly on the indicator may lead to problems of circularity, as emphasized by Woodford(1994).

Second, the predictive power of the spread is likely to hinge on the extent to which financial conditions in the high yield bond market are highly correlated with financial conditions in other credit markets, particularly the market for bank loans.[23] We provided informal evidence to show that this high correlation was present over the sample we examined, particularly during the recessionary period. Situations could arise, however, where the spread might not acurately gauge overall credit conditions. For example, the recent rise in the high yield bond spread was due in part to factors idiosyncratic to this market (i.e., the Russian bond default) and not symptomatic of a systematic deterioration of credit condi-

[22] As we discussed earlier (see footnote 11), however, dummying out the observations on the high yield spread over the period 1989:4-1990:4 does not perceptively weaken the explanatory power that the high yield spread has for the output gap a year ahead.

[23] Thus, for example, even if direct bond financing is small relative to bank finance, as for example is the case in Europe today, the spread emerging from a liquid high yield market can still be informative about the course of the overall economy, to the extent financial conditions are correlated across markets.

tions, of the kind that occurred in the late 1980s. In this recent episode, banks remained in relatively good financial health and, accordingly, were in a position to supply funds to offset the disruption of the high yield market (with the support of an appropriately accommodative monetary policy)[24]. Similarly, Y2K problems could create idiosyncratic problems in the high yield market that could mute the overall informativeness of the high yield spread. What all this suggests, is that it may be desirable to develop a general economy-wide index of financial conditions, of which the high yield bond spread is one component.

[24]For a discussion of the substitution between bond and bank credit over this period, see Saidenberg and Strahan (1999).

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Table 1

Bivariate Regressions Predicting GDPGAP

Importance of High Yield – AAA Bond Spread

	1981:Q1-1999:Q1		1986:Q1-1999:Q1	
	1 Quarter Ahead	1 Year Ahead	1 Quarter Ahead	1 Year Ahead
p-Value for Joint Significance	0.14	0.00	0.02	0.00
Sum of Coefficients	-0.001	-0.01	-0.002	-0.01
p-Value	0.08	0.01	0.00	0.00

Table 2

Trivariate Regressions Predicting GDPGAP

A. High Yield - AAA Bond Spread Relative to Commercial Paper - Treasury Bill Spread

	1981:Q1-1999:Q1		1986:Q1-1999:Q1	
	1 Quarter Ahead	1 Year Ahead	1 Quarter Ahead	1 Year Ahead
p-Value for				
HYAAA	0.26	0.04	0.00	0.00
CPTBSP	0.03	0.20	0.13	0.00

B. High Yield – AAA Bond Spread Relative to the Term Spread

	1981:Q1-1999:Q1		1986:Q1-1999:Q1	
	1 Quarter Ahead	1 Year Ahead	1 Quarter Ahead	1 Year Ahead
p-Value for				
HYAAA	0.17	0.01	0.02	0.00
TERMSP	0.00	0.00	0.97	0.20

Table 3

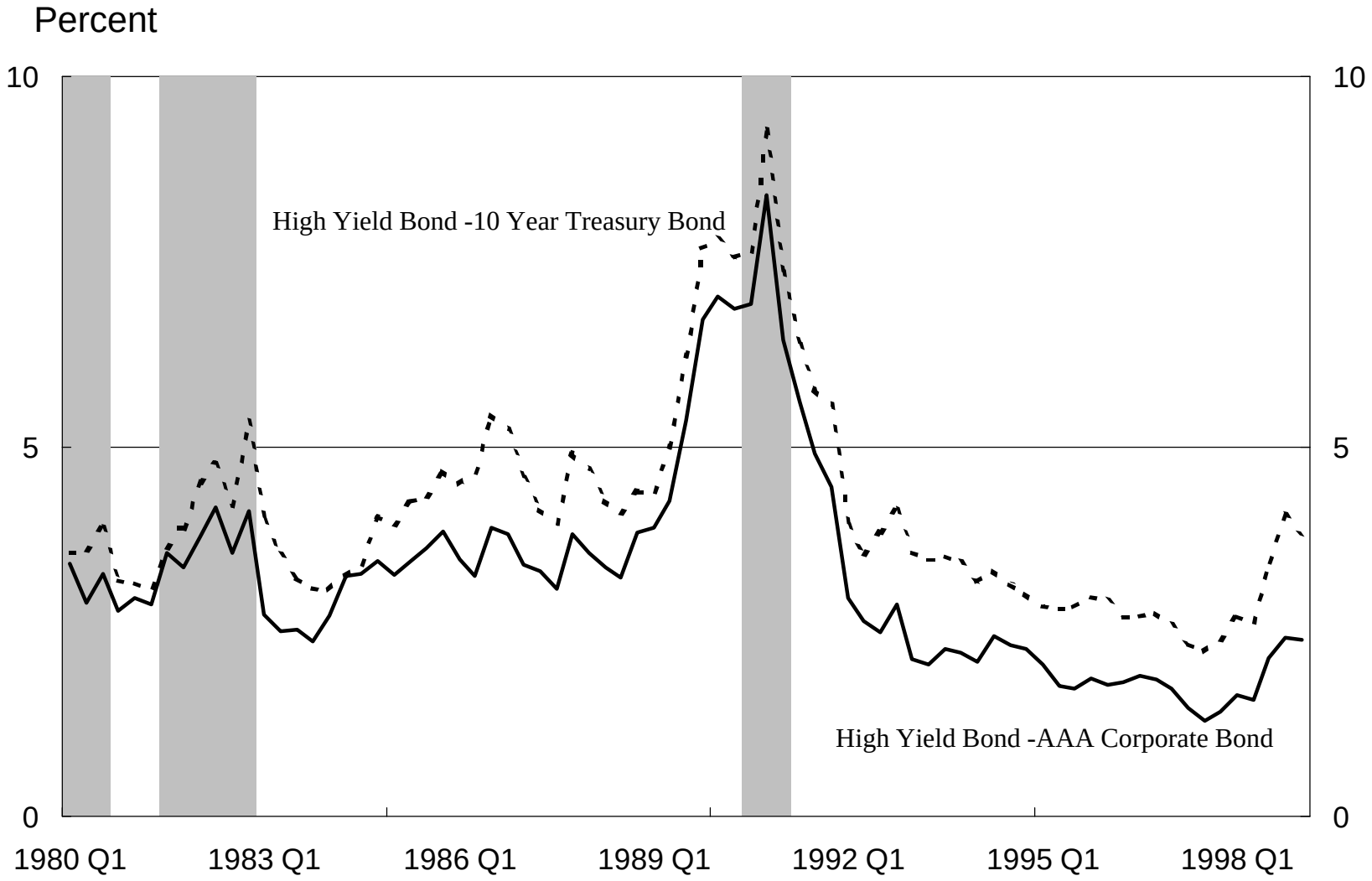
Trivariate Regressions Predicting GDPGAP

High Yield - AAA Bond Spread Relative to Oil Prices and Monetary Policy Indicators

	1981:Q1-1999:Q1		1986:Q1-1999:Q1	
	1 Quarter Ahead	1 Year Ahead	1 Quarter Ahead	1 Year Ahead
p-Value for				
HYAAA	0.32	0.23	0.07	0.00
Real Oil Prices	0.58	0.00	0.97	0.09
HYAAA	0.13	0.02	0.02	0.00
Nom. M2 Growth	0.79	0.99	0.66	0.08
HYAAA	0.10	0.00	0.07	0.00
Real M2 Growth	0.20	0.01	0.82	0.18
HYAAA	0.58	0.04	0.02	0.00
Nom. FF	0.00	0.00	0.42	0.22
HYAAA	0.58	0.04	0.02	0.00
Real FF	0.00	0.00	0.42	0.21

Figure 1

The High Yield Bond Rate



Shading indicates periods of recession

Figure 2

Cross-Correlation: High Yield - AAA Bond Rate and GDP Gap

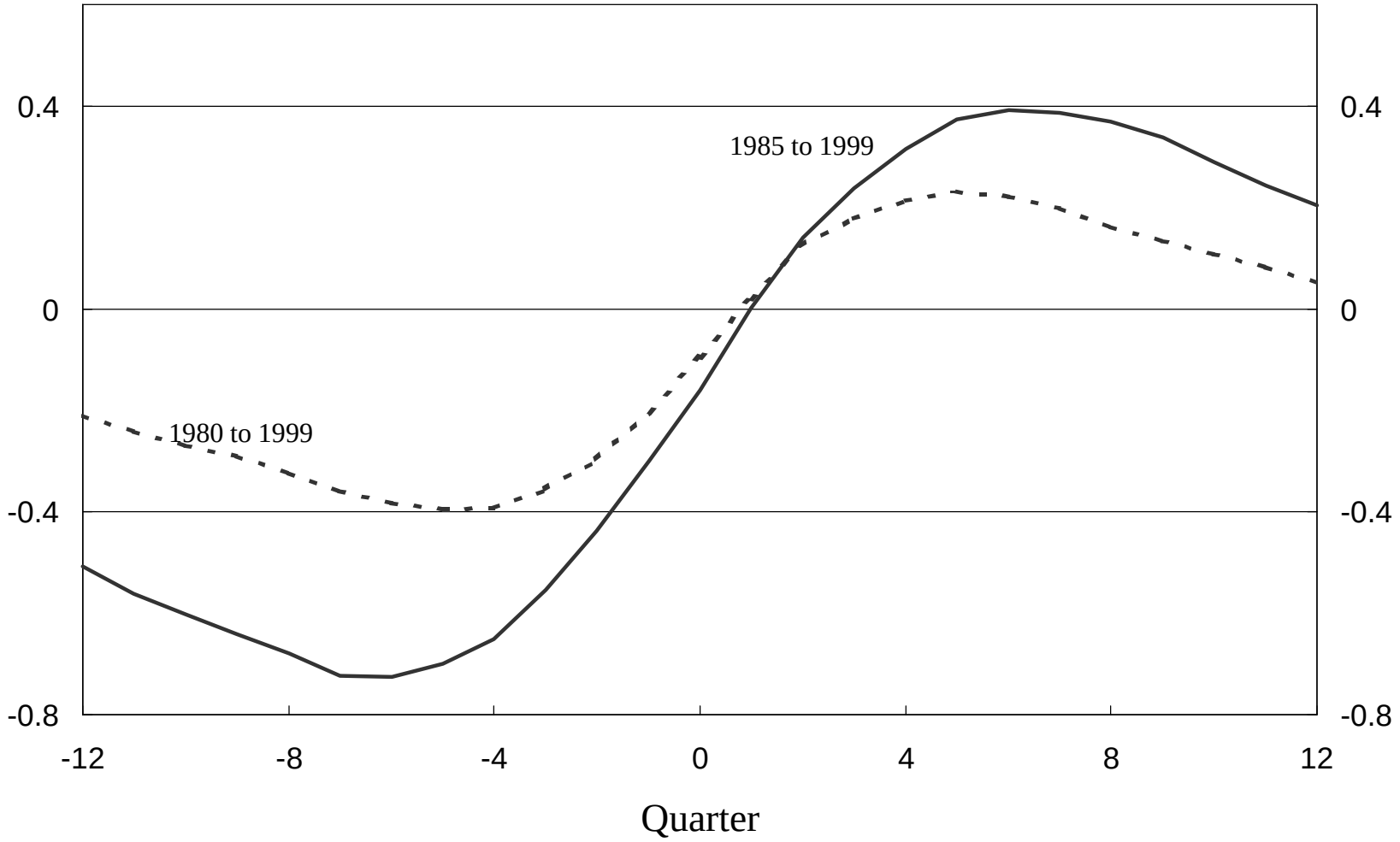
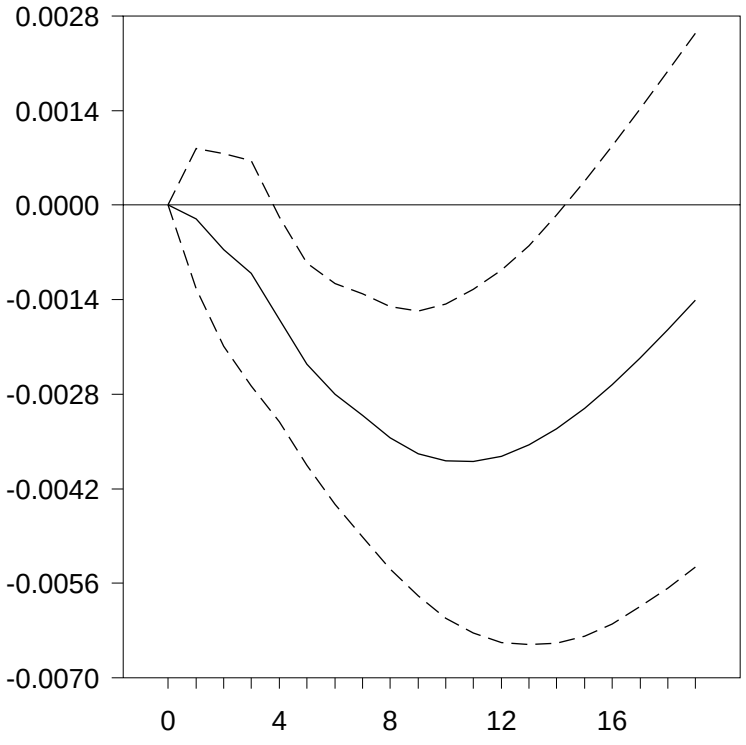


Figure 3

Impact of the High Yeld spread on the Output Gap: 1986:1 - 1999:1



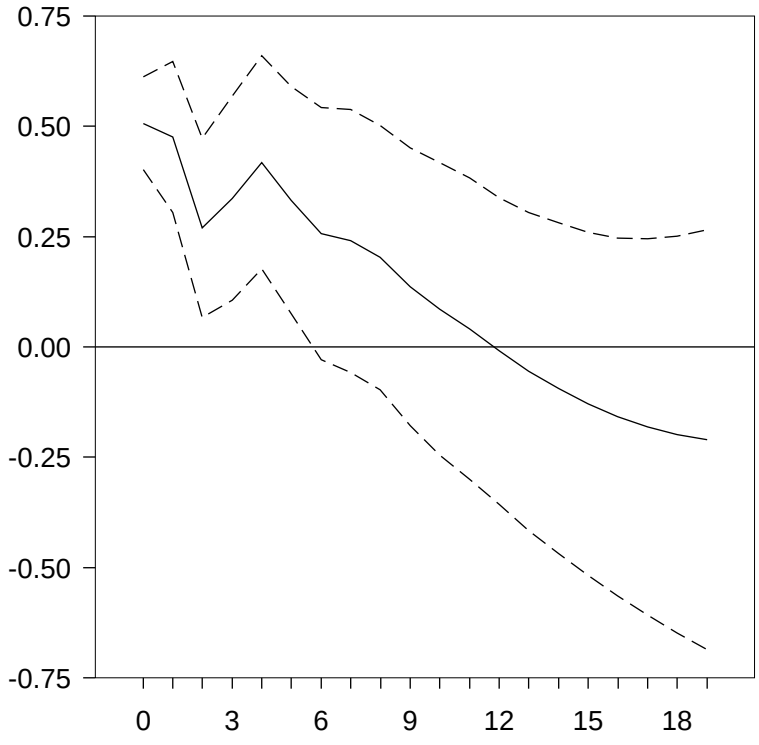
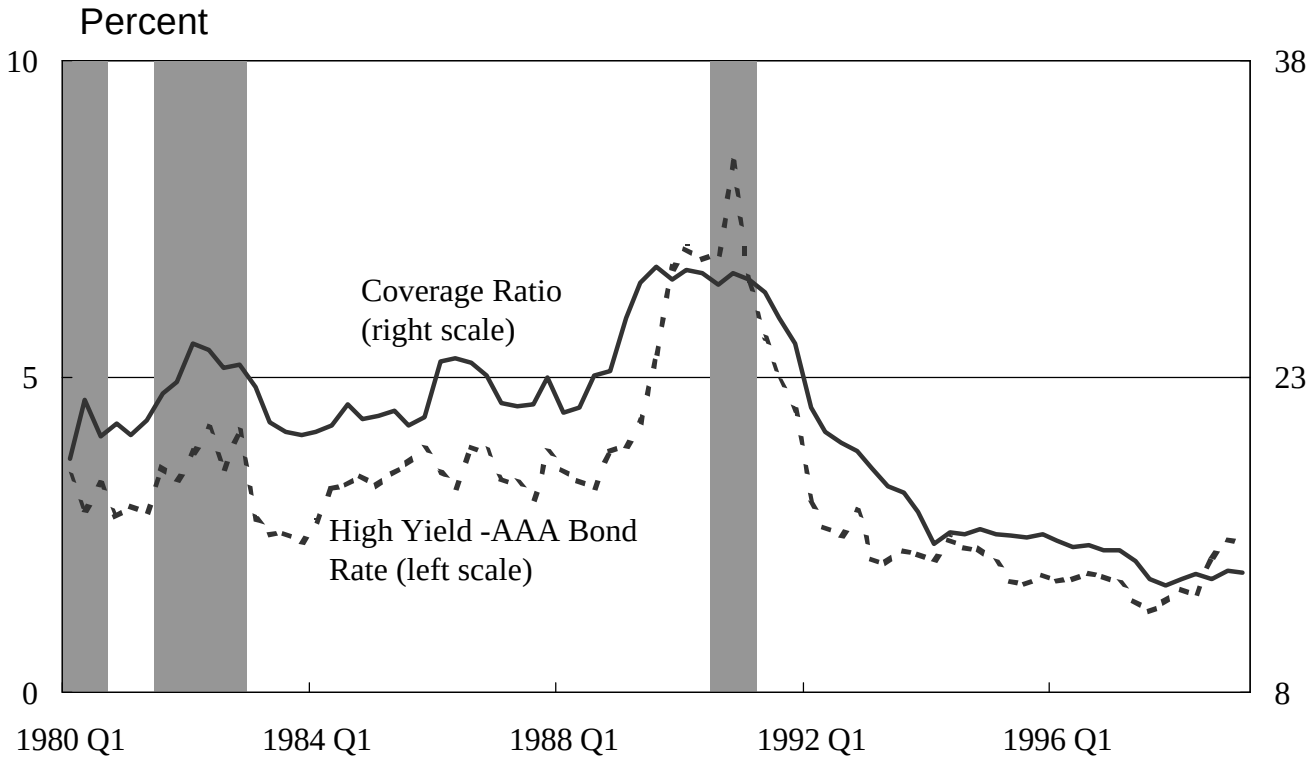


Figure 4

Financial Indicators



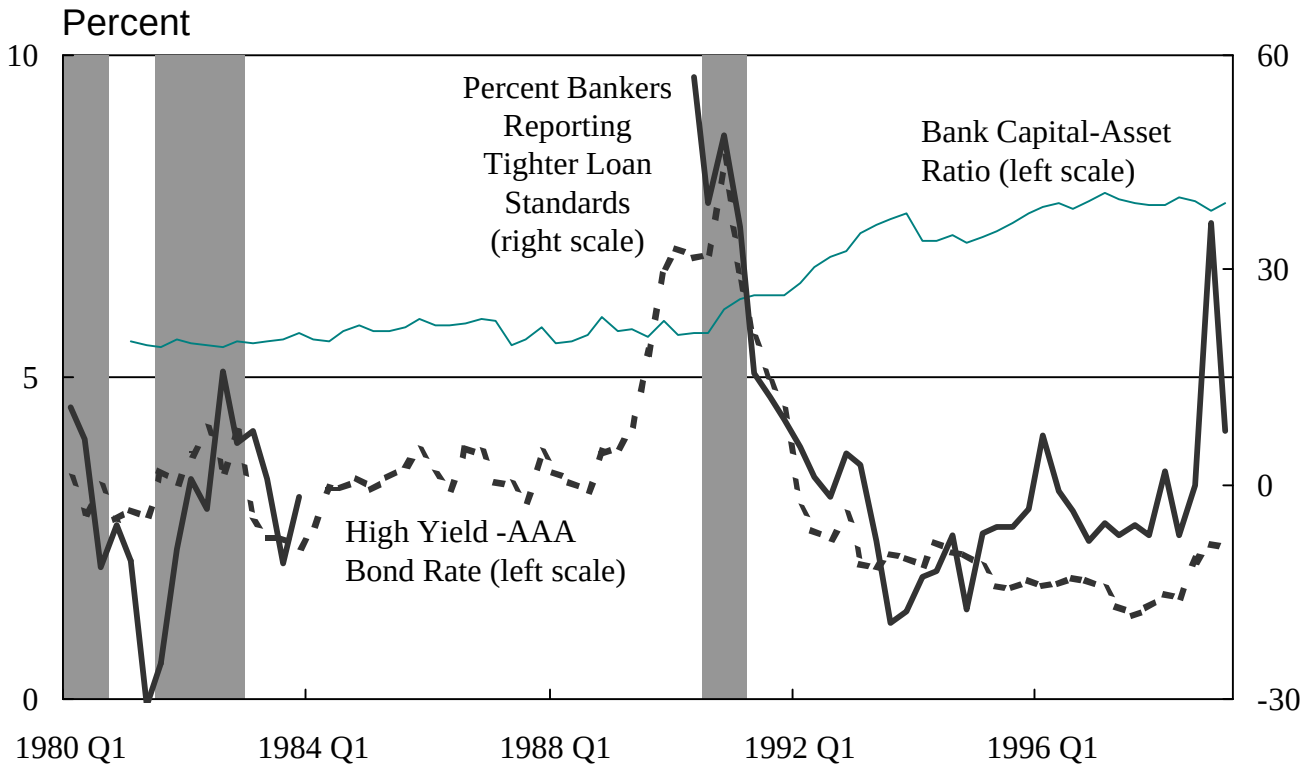
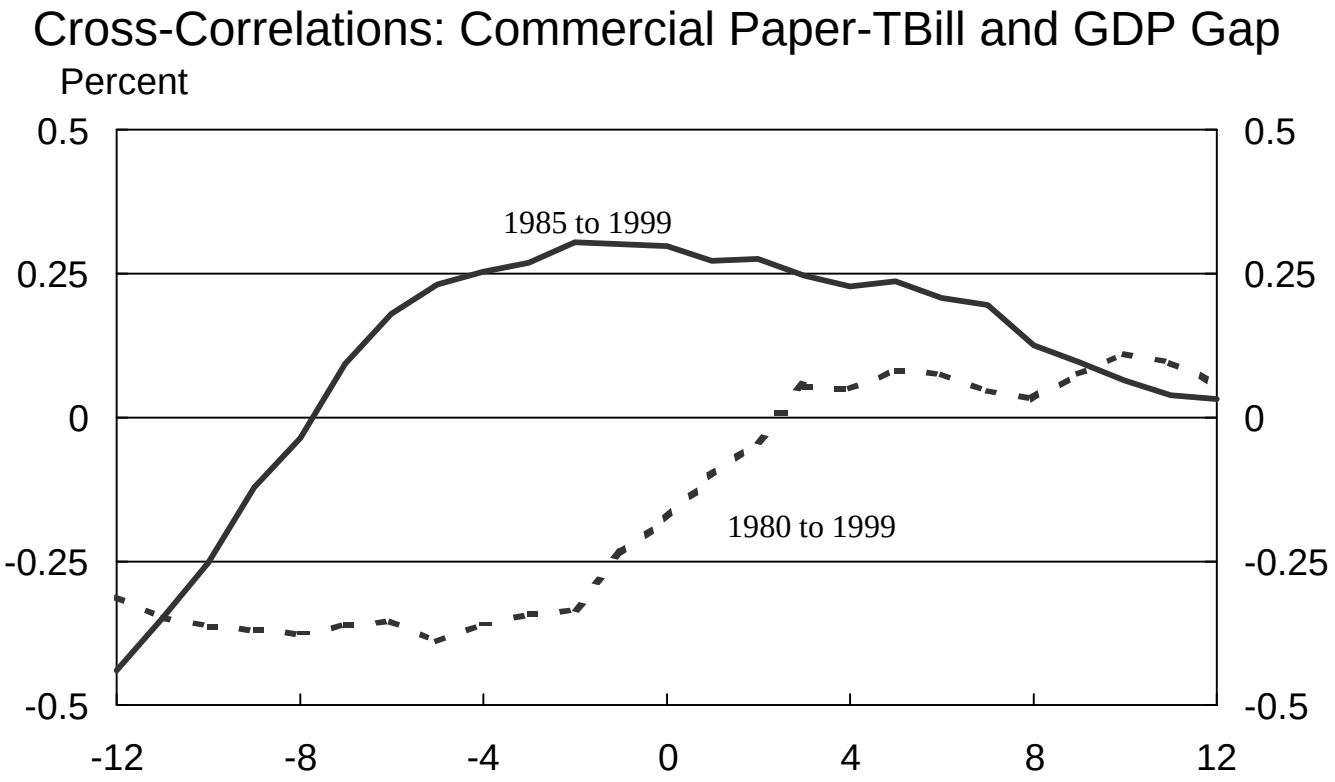


Figure 5


Cross-Correlations: Commercial Paper-TBill and GDP Gap
Percent
0.5
0.25
0
-0.25
-0.5
1985 to 1999
1980 to 1999
-12
-8
-4
0
4
8
12

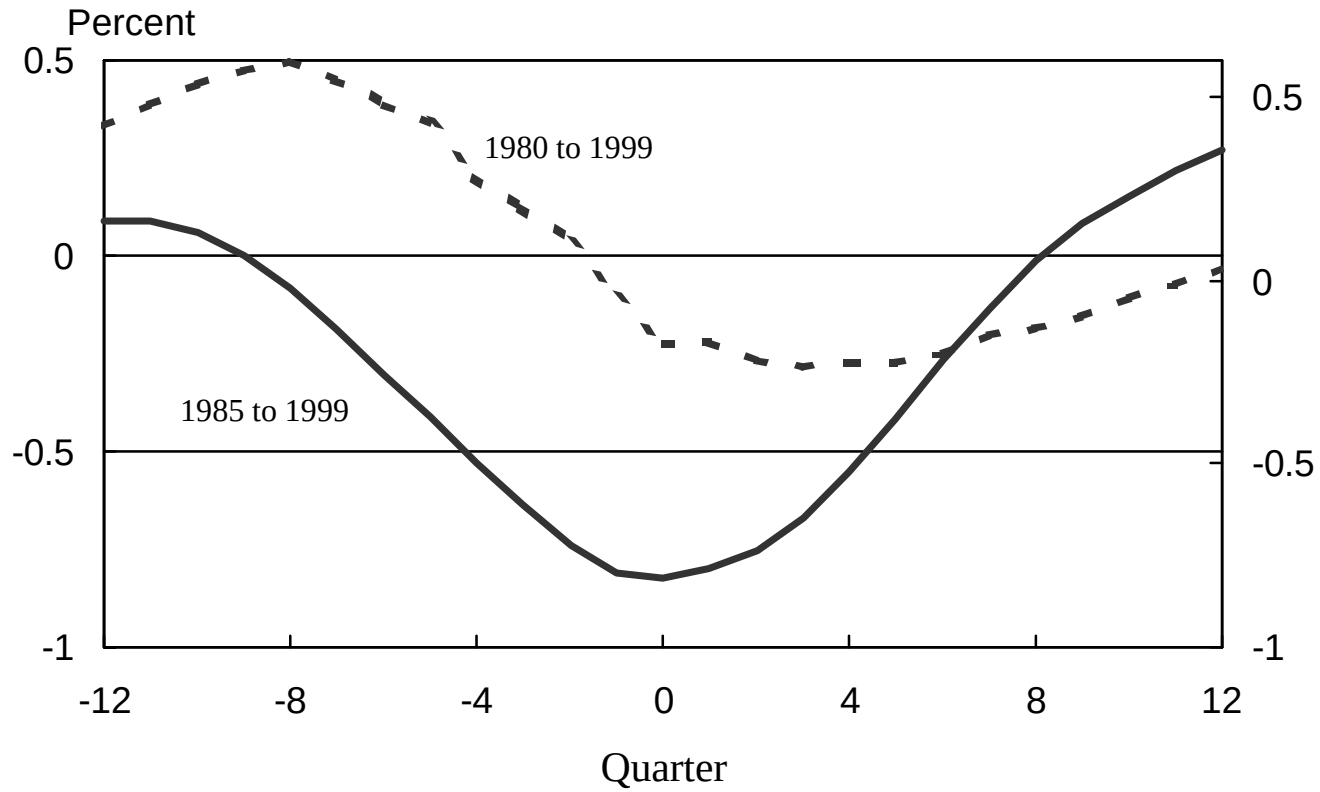
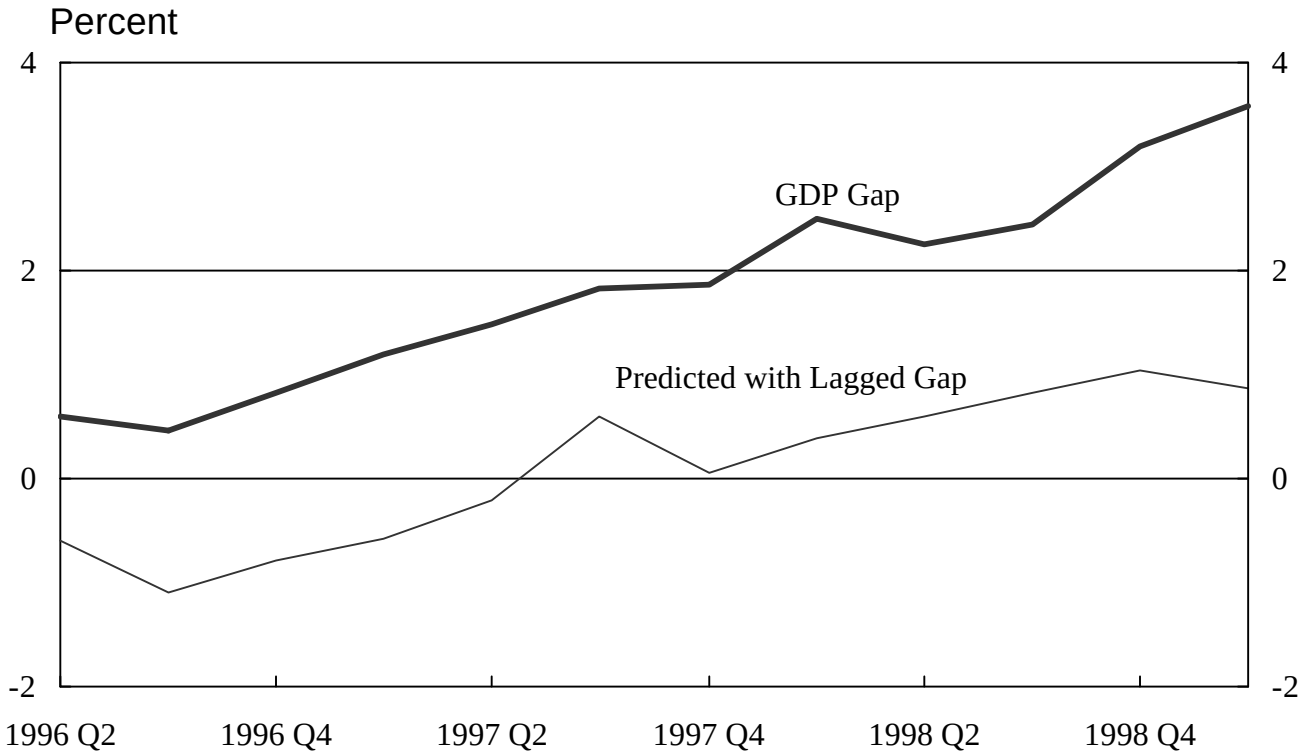

Cross-Correlations: 10 Yr-1 Yr Treasury Rate and GDP Gap
Percent
0.5
0
-0.5
-1
1980 to 1999
1985 to 1999
-12
-8
-4
0
4
8
12
Quarter

Figure 6

Out of Sample Forecasts - 1 Quarter Ahead



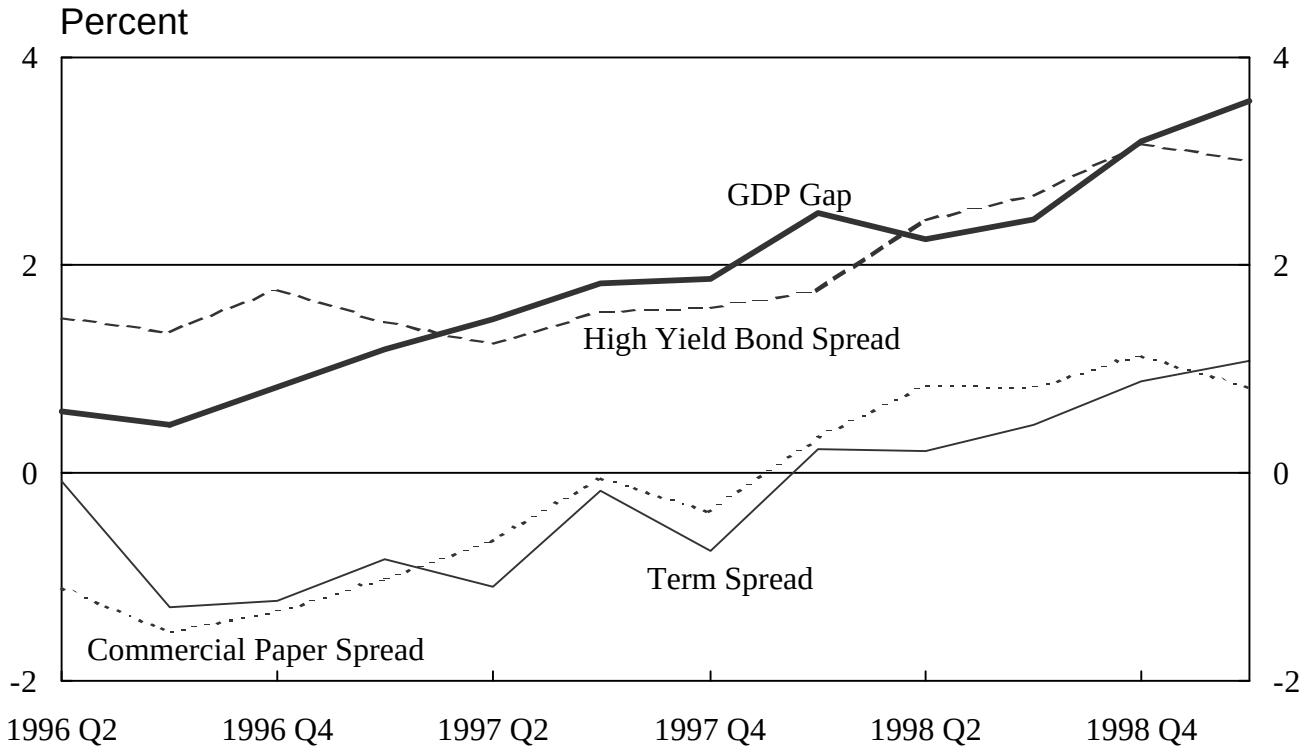
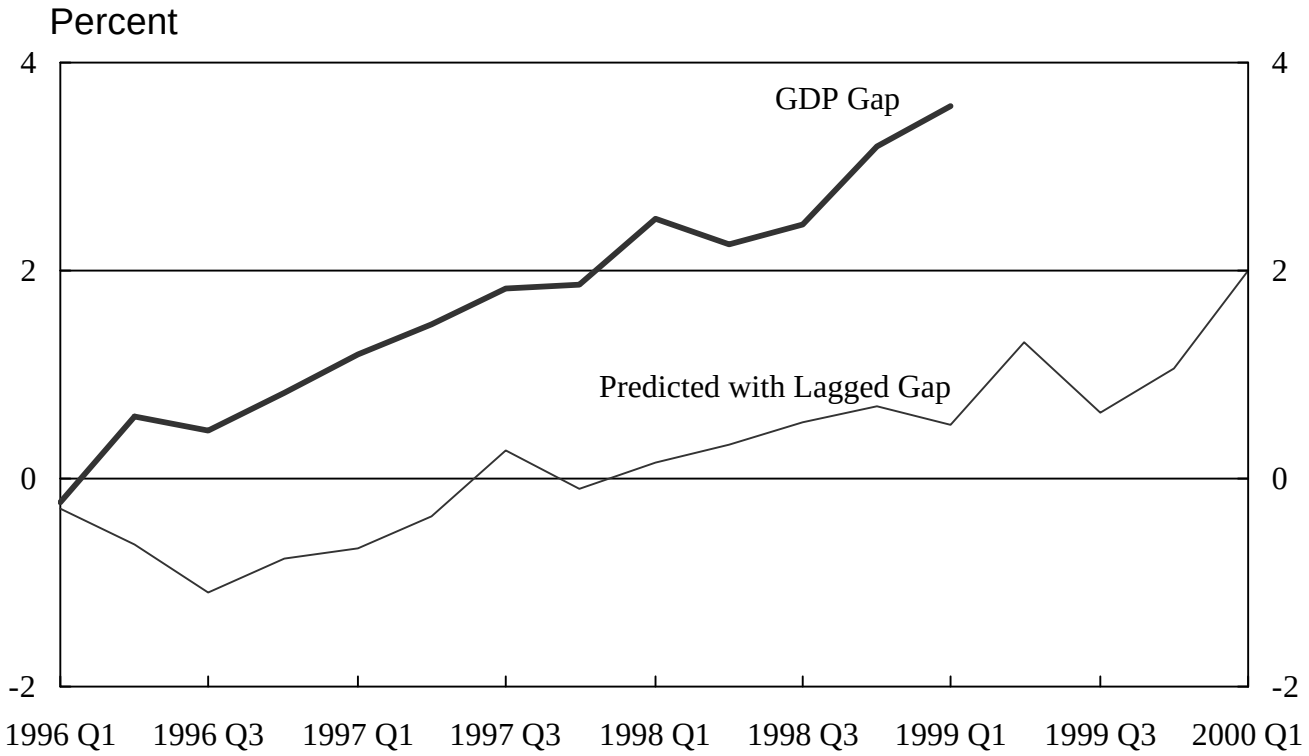


Figure 7

Out of Sample Forecasts - 1 Year Ahead



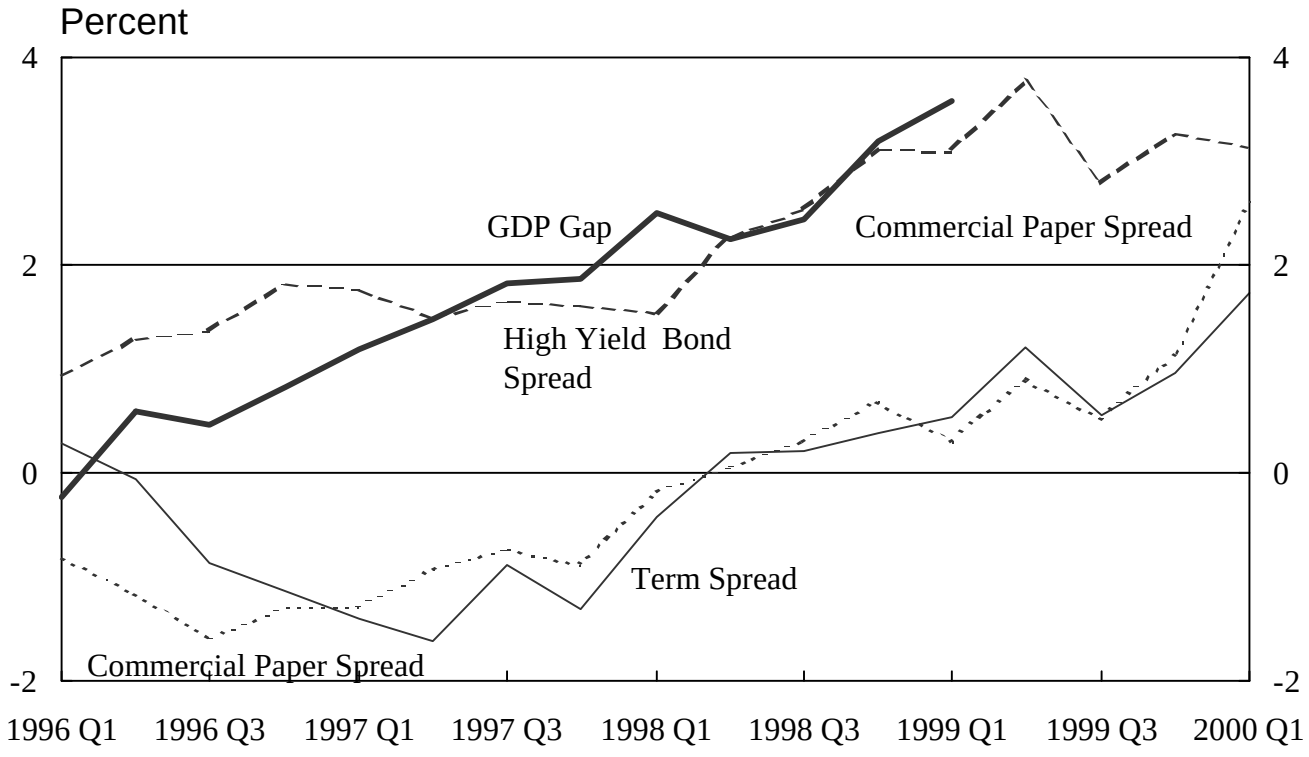
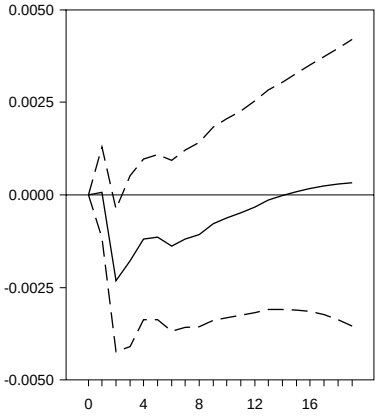
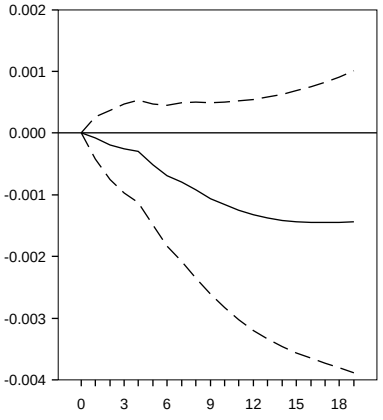


Figure 8a

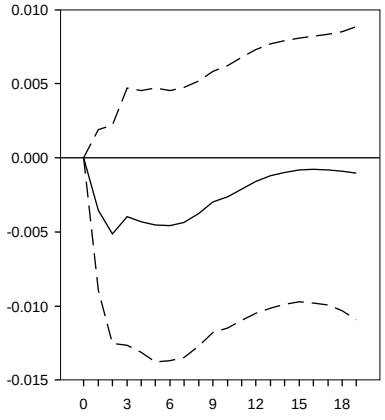
Impact of Federal Funds rate shock: 1979:4 - 1999:1



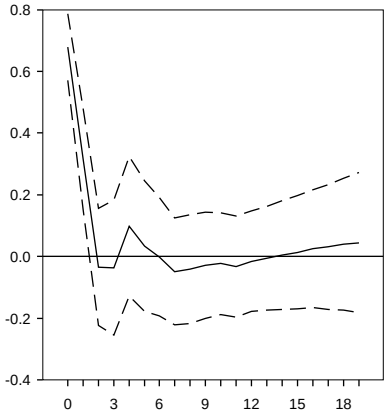
Resp of GDP



Resp of DEFL



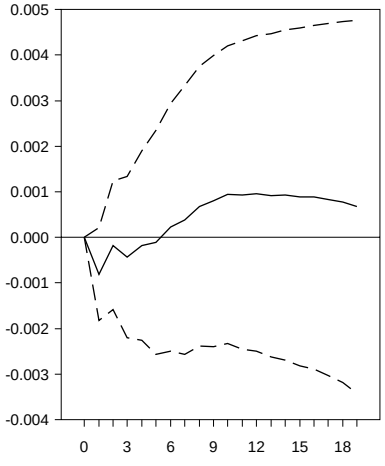
Resp of PCOM



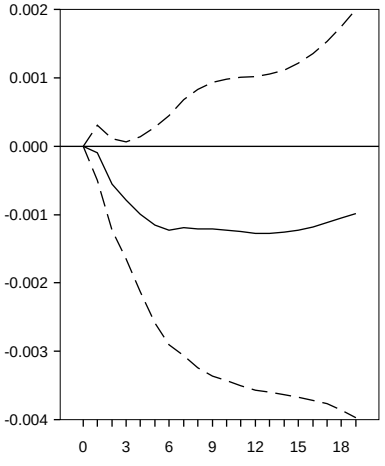
Resp of FF

Figure 8b

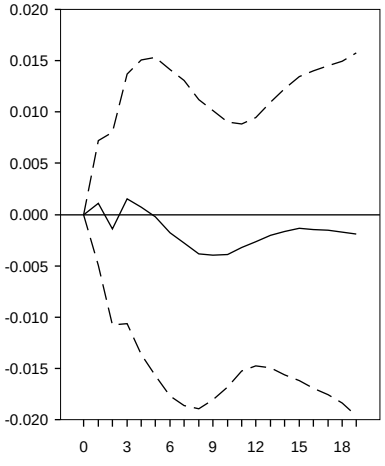
Impact of Federal Funds rate shock: 1986:1 - 1999:1



Resp of GDP



Resp of DEFL



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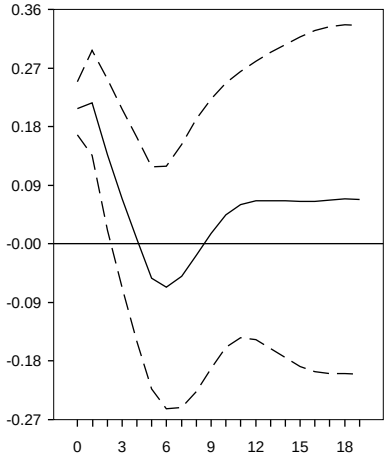

Resp of FF

Figure 9

Impact of High Yeld spread shock: 1986:1 - 1999:1