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The Fed and the Question of Financial Stability: An Empirical Investigation

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Résumé

Comme l'ont montré Borio et Lowe (2002), la stabilité monétaire n'est pas une condition suffisante pour garantir la stabilité financière et, dans certaines circonstances, il s'agit d'effectuer un arbitrage entre ces deux objectifs. Cet article analyse la façon dont la Réserve Fédérale gère ce conflit potentiel. Il montre que la banque centrale américaine réagit à l'évolution des « spreads » de crédit – indicateur de la stabilité financière - au-delà de leur seul contenu en information sur l'inflation et l'activité future. Par ailleurs, une approche non-paramétrique suggère que les erreurs de prévision de la Fed en termes d'inflation et d'activité sont d'autant plus importantes qu'elles sont formulées dans un contexte de tension significative sur les spreads. Dès lors, la sur-réaction aux spreads (« assouplissements préventifs ») est une façon pour la Fed de prendre en compte les incertitudes sur les prévisions centrales. Cette sur-réaction peut être perçue comme le moyen d'assurer l'économie contre le risque accru d'occurrence d'un évènement extrême particulièrement pénalisant : une crise financière suivie d'une déflation.

Mots-clés : Spreads de crédit, règle de Taylor, estimation non paramétrique.

Classification JEL : E58, E44, C14, C52.

Abstract

This paper shows that the Fed reacts to change in spreads between corporate bond yields and government bond yields over and beyond their information content on future inflation and future activity. This result, obtained in a GMM framework, is confirmed by simulation methods. Moreover, when credit spreads are on the rise, the probability that the Fed will make a large error in forecasting output and inflation increases. In this sense, the Fed's preemptive easings – despite their short-term costs, as monetary policy may become too accommodative – are a way to take into account the downside risks to the baseline forecasts and insure the economy against increasing uncertainty and the likelihood of a very costly extreme event.

Keywords: Credit Spreads, Taylor Rule, Non-paprametric estimation, Greenbook forecasts

JEL Classification: E58, E44, C14, C52.

Résumé non technique

Comme Borio et Lowe (2002) l'ont montré, la stabilité monétaire n'est pas une condition suffisante pour garantir la stabilité financière et, dans certaines circonstances, il s'agit d'effectuer un arbitrage entre ces deux objectifs. Un conflit potentiel se manifeste dans une situation où les déséquilibres financiers (excès d'endettement, formation de bulles sur le prix des actifs …) s'accumulent alors même que les anticipations d'inflation demeurent contenues. La banque centrale doit-elle dans ce cas monter les taux de manière préventive ? Cette question a été largement discutée dans la littérature. De même, un conflit entre les deux objectifs peut se produire lorsque l'économie entre dans une phase de perturbation sur les marchés financiers, caractérisée par un plongeon de la Bourse et une tension sur les « spreads » de crédit. Dans ce cas, il pourrait être approprié d'assouplir la politique monétaire au-delà de ce qui serait justifié par de strictes considérations de stabilité des prix, afin d'assurer l'économie contre les effets adverses durables d'une crise financière (dans l'hypothèse où elle se produirait).

L'objectif de cet article est d'analyser la façon dont la Réserve Fédérale gère ce conflit potentiel. Jusqu'à présent, la littérature empirique (Bernanke et Gertler [1999], Rigobon et Sack [2001]) s'est concentrée principalement sur les rendements boursiers : elle montre que la Fed ne réagit à la performance de la Bourse que dans la mesure où cette dernière apporte de l'information sur l'inflation et l'activité future. Dans cet article, on teste la réaction de la Fed à d'autres indicateurs de stabilité financière comme les « spreads » de crédit (i.e. l'écart entre le rendement des obligations d'Etat et celui des obligations émises par les entreprises).

On montre dans un premier temps que, au cours de la récession de 1990/1991, la Fed a réagi à l'évolution des « spreads » de crédit au-delà de leur contenu en information sur l'inflation et l'activité future. Ce résultat préliminaire est confirmé par une estimation par GMM sur la période [1982 : 10 – 2001 : 08] et une série de tests de robustesse: faisant suite à une hausse des « spreads » de crédit et toutes choses égales par ailleurs, la Fed baisse les taux d'un montant du même ordre de grandeur.

Dans un second temps, on développe une approche non-paramétrique qui montre que les erreurs de prévision de la Fed en termes d'inflation et d'activité (mesurées par les

Greenbooks forecasts) sont d'autant plus importantes qu'elles sont formulées dans un contexte où les « spreads » de crédit se tendent de manière significative. Ainsi, la réaction de la Fed à la hausse des « spreads » est une façon de prendre en compte les incertitudes sur les prévisions centrales. Elle peut être perçue comme un moyen d'assurer l'économie contre le risque accru d'occurrence d'un évènement extrême particulièrement pénalisant : une crise financière suivie d'une déflation.

Non technical summary

As shown by Borio and Lowe (2002), monetary stability is not a sufficient condition for financial stability and, in some circumstances, there is a trade-off to be made between these two objectives. A situation of potential conflict arises when financial imbalances (excess lending, speculative bubbles …) build up while inflation expectations remain subdued. Other studies have already extensively explored the issue of whether the central bank should raise rates preemptively in this situation. A conflict could also occur when the economy enters a period of financial turmoil characterized by rising credit spreads and a stock market plunge. In this case, it might be appropriate to ease monetary policy over and beyond what would be justified for price stability considerations in order to insure the economy against the strong and long-lasting averse effects of a financial crisis should it occur.

The goal of this paper is to document the way the Federal Reserve manages this potential conflict. So far, the empirical literature (Bernanke and Gertler [1999], Rigobon and Sack [2001]) has mainly focused on stock returns: it shows that the Fed reacts to stock returns only to the extent that they convey information on future inflation and future output. In the paper, we test the Fed's reaction to other financial stability indicators such as credit spreads (i.e. the spreads between corporate bonds and government bonds).

Focusing first on the 1990/1991 recession in the US, we document some casual evidence suggesting that the Fed may react to the credit spreads over and beyond their information content on future inflation and real activity. This preliminary result is confirmed by a GMM estimation on the [1982:10 - 2001:08] period (and several robustness tests): following a rise in credit spreads, the Fed lowers rates by an amount of about the same magnitude.

We then develop a non-parametric approach which shows that, when credit spreads are on the rise, the probability that the Fed will make a large error in predicting future inflation and future output (measured by the *Greenbook forecasts*) increases. In this sense, the Fed's over-reaction to a rise in credit spreads (pre-emptive easing) is a way to take into account the downside risks to the baseline forecasts and insure the economy against the increased likelihood of a very costly extreme event: a financial crisis, leading to a deflation.

1. Introduction

Asset prices booms and busts have often led to major financial crises in the past (e.g. the U.S. Great Depression between 1929 and 1933, or Japan during the 1990s). The adverse effects which follow (credit crunch, output contraction, deflation) can be strong and long-lasting. Therefore, ensuring financial stability becomes a major goal for central banks along with the more traditional objective of maintaining monetary stability.

However, as shown by Borio and Lowe (2002), monetary stability is not a sufficient condition for financial stability and, in some circumstances, there is a trade-off to be made between these two objectives. As pointed out by Issing (2003), defining the notion of financial stability determines the conditions of the trade-off between the two objectives: if financial stability is simply defined as financial variables smoothness (including interest-rates), the trade-off with price (and output) stability immediately follows from the Poole's result, as long as the economy faces mainly aggregate demand shocks (and few money demand shocks)[2]. Adopting Mishkin's definition (1991), we consider financial stability as the capacity of the financial system to ensure, in a lasting way and without major disruptions, an efficient allocation of savings to investment opportunities.

With this broad definition in mind, the conflict is still there. In particular, it occurs when financial imbalances (as measured by a *credit gap*, an *asset gap* or an *investment gap*[3]) develop in a context of subdued inflation expectations. As shown by Borio and Lowe (2002) in a panel study of thirty-four countries including all of the G-10, financial

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[2] If the assumption is valid, monetary-targeting dominates interest-rate targeting in reducing price and output variability, at the expense, though, of interest-rate volatility.

imbalances are reliable indicators of future financial crises, and it may be efficient to tighten monetary policy in a preemptive way (i.e. to react to these indicators over and beyond their information content on future inflation and future output) before waiting for these imbalances to unwind. Another situation of potential conflict between monetary and financial stability arises when the economy enters a period of financial turmoil characterized for example by rising credit spreads and a stock market plunge. In this case, it might be appropriate to ease monetary policy over and beyond what would be justified for price stability considerations (preemptive easing) in order to insure the economy against the strong and long-lasting averse effects of a financial crisis should it occur (even if the probability of such an extreme event is small).

The goal of this paper is to document the way the Federal Reserve manages this potential conflict between monetary and financial stability. So far, the empirical literature (Bernanke and Gertler [1999], Rigobon and Sack [2001]) has mainly focused on stock returns: it shows that the Fed reacts to stock returns only to the extent that they convey information on future inflation and future output. Since stock returns turn out to be a poor predictor of future inflation or future output in the U.S. (see Stock and Watson [2000], Goodhart and Hofmann [2000] or Filardo [2000]), the performance of the stock market seems to play at best a limited role in the Fed's assessment of what should be the optimal level of interest rates. However, examining fifteen historical episodes of stock market crashes and their aftermath in the United States over the last one hundred years, Mishkin and White (2002) argue that monetary authorities should focus on financial stability indicators rather than on the stock market. Stock market booms and busts *per se* are not

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[3] A credit gap (an asset gap and an investment gap, respectively) arises when the ratio of credit to GDP (real asset prices and the ratio of investment to GDP, respectively) deviates from its trend by a specified

the problem: in the cases where financial instability (measured in their study by an increase in the Baa/Aaa spread) did not appear, economic downturns following the crash tended to be fairly mild.

What we intend to do in this paper is to test the Fed's reaction to financial stability indicators such as credit spreads (i.e. the spreads between corporate bonds and government bonds). A rise in credit spreads may signal an increase in information asymmetries (Stiglitz and Weiss [1981]) and may reflect an increasing difficulty for lenders to assess the real quality of borrowers, putting financial stability at risk (as financial institutions may be more reluctant to lend). Alternatively, credit spreads proxy the external finance premium (i.e. the gap between the cost of external funds and the cost of internal funds): financial instability may follow the rise in the credit spreads through its impact on demand (as investment slows down[4]), triggering an increase of bad loans and a deterioration of financial institutions' balance sheets, in a mechanism well described by the credit channel proponents (see Bernanke, Gerler and Gilchrist [1999] for example). The surge may also reflect an increase in the perception of risks associated with low-quality debtors, including financial institutions.

Focusing on the 1990/1991 recession in the US, Section 2 documents some casual evidence suggesting that the Fed may react to the credit spreads over and beyond their information content on future inflation and real activity. Section 3 presents some empirical and theoretical arguments for preemptive reactions to financial (in)stability indicators (either preemptive tightening or preemptive easing). In particular, it develops a

amount.

[4] The mechanism is compounded when the surge in credit spreads follow a slump in asset prices.

non-parametric approach which shows that over-reacting to a rise in credit spreads (preemptive easing) is a way to take into account the downside risks to the baseline forecasts and insure the economy against the increased likelihood of a very costly extreme event: a financial crisis. Section 4 investigates how the Fed acts in this respect. It shows in a GMM framework that the Fed reacts to the change in credit spreads over and beyond their information content. Section 5 investigates the robustness of the result. Section 6 concludes.

2. Some casual evidence: the 1990/1991 recession

Recently, the Fed seemed more prone to ease monetary policy in a context of depressed stock prices (e.g. after the collapse of the stock market in 2001) than to tighten monetary policy in a buoyant market (e.g. in 1999). But to be more conclusive on this period, we would need to look at the *Greenbook Forecasts*, which are not yet available[5]. In particular, these interest rate moves could be explained by revisions in expected inflation and expected output gap without constituting evidence of over-reacting to financial stability variables. However, the 1990/1991 recession could give some casual evidence of such a reaction to financial stability variables: the SP500 lost 29 % between September and October and lost an additional 5 % in December. On the same period, the spread between Baa corporate bonds and government bonds widened by 31 basis points.

Between September and December 1990, the Fed's real GNP forecasts on a one-year horizon – as measured by the *Greenbook Forecasts* – were unchanged (at 2.4 %) and the Fed's inflation forecasts on a one-year horizon were lowered from 5.4 % to 4.8 %. Assuming that the Fed's behavior is well approximated by a standard forward-looking

Taylor rule at the time, this inflation forecast revision should have prompted a Fed Funds target drop of about 180 basis points from September to December[6]. Given the high level of interest-rate smoothing, the Fed Funds rate itself should have decreased by about 60 basis points on the quarter[7]. Instead, the Fed Funds rate was lowered by 90 basis points. This might indicate that, concerned with the risk of financial instability, the Fed reacted to financial instability indicators (i.e. decreasing stock returns and rising credit spreads) over and beyond their information content on future inflation and future output.

Note that, ex post facto, this overreaction to financial instability indicators may have been optimal since the 1990/1991 recession was eventually larger than what the Fed had expected at the time. In particular, its GNP November forecast for 1991Q1 was –1.1 % (annualized rate) instead of the trough of –2.7 % which actually occurred. And the Fed forecast for 1991Q3 was 2.2 % instead of a "true" growth rate of 0.8 %.

3. Is there some ground for preemptive reactions to financial (in)stability indicators?

This section reviews some theoretical and empirical arguments that may incite the central bank to react to asset prices – or more generally to financial stability indicators – over and beyond their information content on future inflation and future activity. The first thing worth noting is that having information content on future inflation (or future output) is not a sufficient condition for a variable to be explicitly included in the central bank reaction function (along with expected inflation and the expected output gap). For example, asset prices are in general much more volatile than the price of goods and

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[5] They are released with a 5 year lag.

[6] The Taylor rule coefficient to the expected inflation on a one-year horizon is estimated to be around 3 on the period [1982:10 - 2000:08].

services. Therefore, even if the returns on one given asset help predict inflation (as it is the case for real estate for example[8]), the central bank's reaction to this asset might not improve economic performance, since it might increase interest rate variability (and given the causality running from interest-rate to inflation and output, it might increase inflation and output variability as well).

a) Reacting to financial imbalances: a case for preemptive tightenings?

Asset price misalignments (the gap between the market price of an asset and its "fundamental" value) could reflect "speculative bubbles" (rational ones, *à la* Blanchard and Watson [1982], or irrational ones). When the bubble bursts – which happens sooner or later - a lot of borrowers who had expected to pay back their debts with capital gains go bankrupt. The financial system is weakened so much that the economy staggers for years (Japan during the 1990s). In this respect, it might be efficient to burst the bubble as soon as possible and therefore, in certain circumstances, to react to an *asset gap* by tightening monetary policy over and beyond what would be required for price stability considerations.

Cecchetti *et al* (2000) have shown that in simple cases where the central bank 1) knows with certainty that the stock market boom is driven by non-fundamentals and 2) knows exactly at what time the bubble will burst (i.e. after five periods in their simulations), it is "optimal" for the central bank to react systematically to stock returns over and beyond their information content. However, as Mishkin (2001) points out, this supposes that the central bank has an informational advantage over the private sector

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[7] The degree of interest-rate smoothing is estimated to be 0.85 on the period [1982:10 - 2000:08].

(otherwise, if everyone knows that there is a bubble and when it is going to burst, there is no bubble any more), which remains to be shown[9]. Moreover, it is hard to detect – even ex-post – if the stock market boom is driven by non-fundamentals. The rise in stock prices could result from a positive supply shock signaling permanent productivity gains, a situation in which the central bank should not over-react.

Bernanke and Gertler ([1999] and [2001]) show that when you relax the Cecchetti *et al* assumptions (and in particular when you take into account the probabilistic nature of a bubble), the small benefits in terms of reduced output gap variability of responding to stock prices are likely to be outweighed by the associated increase in inflation variability. In any case, their simulations show that allowing the policy rule to respond to the output gap (along with the inflation rate) eliminates any benefits of responding to stock prices.

If reacting directly to stock returns may not be the best answer, reacting to financial imbalances such as an excess growth of credit relative to the GDP may be appropriate in certain circumstances, as economic history shows that most asset price booms are fueled by a rapid expansion of liquidity on the market (Borio, Kennedy and Prowse [1994], Kindleberger [1989], Borio and Lowe [2002], Schwarz [2002]).

What could be an incentive to monitor asset market developments is not limited to the stock market: Hilbers, Lei and Zacho (2001) show that real estate price swings often contribute to financial sector distress, hampering its ability to lend to the economy.

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[8] See Filardo (2000) or Goodhart and Hofmann (2000) for example.

[9] Romer and Romer (2000) find that the Fed's forecasts of inflation and output outperform those of the private sector. They conclude that the Fed does possess inside information about the future course of inflation and output and they interpret this informational advantage as stemming from the huge amount of resources the Fed devotes to forecasting relative to individual private sector firms. Peek, Rosengren and Tootell (2003) show that the informational superiority of the Fed over private forecasters is generated by confidential supervisory knowledge about troubled, non-publicly traded financial institutions. The financial condition of banks known by the Fed to be in poor health (information which is never disclosed to the

However, Filardo (2000) shows that in a situation where there is uncertainty concerning the impact of housing prices on future inflation, the potential cost of reacting to housing prices in a case where they do not signal future inflation exceeds the potential benefit of reacting to them in a case where they do have predictive content.

Bordo and Jeanne (2002) advocate that, under certain conditions, preemptive monetary tightenings dominate pure reactive policies (i.e. policies which would deal with the bust of asset prices when it actually occurs). They develop a two-period model in which a drop in asset prices in the second period, by causing a reduction in the value of collaterals, increases the risk of a credit crunch. The larger the accumulated debt during the first period, the greater the risk is. In this framework, a preemptive monetary tightening at period 1 – by reducing the accumulation of debt in period 1 – reduces the risk of a credit crunch at period 2. Bordo and Jeanne show that for intermediate levels of market optimism about the future level of asset prices, the proactive policy dominates the purely reactive one. However, if the degree of market optimism is very high (i.e. if the private sector expects the high level of asset prices to last longer with a probability close to one), monetary authorities would have to raise the real interest to an excessive level in order to insure the economy against a credit crunch (because firms' borrowing is very large). At the same time, since the probability of an asset slump is low, the probability of a credit crunch is limited. Therefore, the cost of the preemptive strike exceeds the benefit of avoiding a credit crunch. Likewise, if the degree of market optimism is very low (i.e. if the probability of having high levels of asset prices at period 2 is very small), firms'

public) turns out to be a good explanatory variable for the gap between the private sector forecasts and the true value of the variables (inflation and unemployment).

borrowing is sufficiently low for the asset price slump – if it occurs – not to trigger a credit crunch.

Contrary to the Cechetti *et al* analysis, the policy implications do not hinge on whether the central bank detects the presence of a speculative bubble. Moreover, it is shown that irrational exuberance broadens the scope for proactive monetary policy to dominate purely reactive policies. However, Bordo and Jeanne suggest that the optimal monetary policy probably does not take the form of a simple mechanical rule such as the Taylor rule, even if it is augmented by a linear term in asset prices. The optimal reaction to asset prices is more likely to be non-linear.

b) Taking into account the downside risks to the baseline forecasts: a case for preemptive easings

Ferguson (2003) recently argued: "There may also be cases in which a central bank faced with the prospect of financial instability needs to adjust policy by more than could be justified solely by the forecasts for output and inflation. In my view, though, this is perfectly consistent with a central bank that conducts monetary policy using forecasts for key macro variables as its primary guideposts but also considers the risks to the forecasts for those key macro variables". The Bank of England's use (and publication) of fan charts is an example of a monetary policy which does not only respond to the baseline scenario but also to the whole distribution of the forecasts around the expected mean[10]. As revealed by the minutes of the Bank of England Monetary Policy Committee meeting of November 3 and 4, 2004, "the economy was probably close to capacity and

[10] See Britton, Fisher and Whitley (1998) for a description of the Bank of England's use of the fan charts.

inflationary pressures seemed likely to build". However, the impact of house price movements (with prices starting to decrease slightly for the first time in years) on consumption was considered as a key uncertainty for the accuracy of the macroeconomic forecasts: "there were considerable uncertainties surrounding the Committee's projections, with the balance of risks somewhat to the downside". As a result, and despite inflationary pressures, the MPC decided not to raise the Repo rate this month.

A recent International Finance Discussion Paper of the Federal Reserve Board (Ahearne *et al* [2002]) show that deflation can be very difficult to predict in advance. In particular, the Japanese slump in the 1990s was anticipated neither by Japanese policymakers, nor by foreign observers (including Federal Reserve staff economists) or financial markets[11]. Based on real-time forecast data and on standard forward-looking Taylor rules, Japanese monetary policy was too loose on average from 1990 through 1994. Using revised data instead, monetary policy was too tight over the same period. Therefore, the authors recommend that monetary policy perhaps should respond not only to baseline forecasts of future activity and prices, but also to the special "downside risks" – in particular, the possibility of deflation – to those forecasts as well. And a depressed stock market or a surge in credit spreads could well make these "downside risks" more likely to happen.

In the following part, we try to flesh out this idea by computing the conditional distribution of the Fed's forecast errors, given the variation in the credit spreads observed at the time the Fed formulates its forecast. The Fed's errors in forecasting are measured by the difference between the true (annualized) quarterly GDP growth rate and the forecast carried out by the Fed for this variable four quarters earlier (*Greenbook*

Forecast). We use the Croushore data base (Federal Reserve of Philadelphia). The forecast for the growth rate on quarter Q year t is extracted from the Greenbook forecast corresponding to the closest FOMC meeting to the middle of quarter Q of year t-1. Since the forecasts are published with a five-year lag, the analysis is led on the period [1974Q4 - 1997Q4] on quarterly data.

What we would like to do in the following section is to compute the conditional distribution function of the Fed forecast errors, given the credit spread variation over the month preceding the month where the forecasts were computed. We carry out a simple non-parametric analysis. The conditional probability of getting an error in prevision y given credit spread variation z is computed using what happened in the estimation sample for "close" values of y and z. The notion of "closeness" is defined using a bandwidth centered at y and z. Among all the observations in the sample, those for which the error in prevision is outside the bandwidth will not be taken into account in the computation. Those for which both the error in prevision and the credit spread variation are inside the bandwidth will be given more weight as they are closer to y and z. The weight we assign to an observation inside the bandwidth is defined by a kernel. The one used in the following computation is the Epanechnikov kernel of parabolic shape: $K(u) = 0.75\ (1-u^2)\ 1(abs(u)<1)$, where 1 is a dummy variable. By construction, the kernel is such that the integral sums up to one. For a bandwidth h, the kernel becomes: $K(u,h) = (1/h)K(u/h)$ so that the integral remains equal to one, and we have simply:

$$E(Y / Z = z) = \sum_{t=1}^{T} K(z-Z_t, h_Z)\ y_t$$

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11 Long–term bonds remained as high as 5 percent up until the start of 1995.

The probability distribution function (pdf) of Z_t at z (where Z_t is the credit spread variation over the month preceding the FOMC meeting closest to the middle of quarter t) is simply given by:

$$f_Z(z, h_Z) = (1/T) \sum_{t=1}^{T} K(z-Z_t, h_Z),$$

where T is the number of observations in the sample and h_Z is the bandwidth for Z. Symmetrically, the pdf of (Y_t, Z_t) at (y,z) (where Y_t is the error in prevision at quarter t) is given by:

$$f_{YZ}(y, z, h_Y, h_Z) = (1/T) \sum_{t=1}^{T} L(y-Y_t, h_Y)\, K(z-Z_t, h_Z)$$

where L is the kernel for Y. Finally, the conditional cumulative distribution function (cdf) of Y given Z = z is estimated at a point y by:

$$\hat{F}(y/z) = \text{Prob}(Y_t < y \setminus Z_t = z) = \int_{-\infty}^{y} F_{YZ}(u, z, h_Y, h_Z)\, du \,/\, F_Z(z, h)$$

And the conditional quantile estimator at p % given Z = z is simply estimated by:

$$\hat{Q}(z,p) = \inf_y \quad [y \,/\, \hat{F}(y/z) > p]$$

The choice of the bandwidth is non-trivial. The most common method for selecting it is that of *cross-validation* (Härdle [1990]). The optimal bandwidth h_Z is the one which minimizes the function:

$$CV(h) = \sum_{t=1}^{T} (Y_t - m_h(Z_t))^2 \text{ with: } m_h(Z_t) = (1/T) \sum_{j \neq t} K(Z_j - Z_t, h)\, Y_j$$

The function CV(h) is called the cross-validation function because it measures the success of the kernel estimator in fitting $\{Y_t\}$ across the T subsamples $\{Z_t, Y_t\}_{t \neq j}$, each with one observation omitted. The minimum of the function is found for h_Z = 0.45. The value obtained confirms the heuristic rule that the optimal value is found in a region where the conditional probability as a function of the bandwidth is relatively stable (see Table 1).

With $h_Z = 0.45$, we find: $E(y / z = 0) = 0.20$ % and $E(y / z = 0.25) = 0.10$ %. This means that there is no systematic error in the Fed forecasts: in average, the Fed underestimates annualized GDP growth by 0.20 % when credit spreads remains constant on the month preceding the Fed forecast, and by 0.10 % when they have picked up by 25 basis points.

With $h_Z = 0.45$ and $h_Y = 3$, we have also: $P(y<-3 \setminus z = 0) = 11.6$ % and $P(y<-3 \setminus z = 0.25) = 14.2$ %. The probability of making large forecast errors and getting a GDP growth rate much smaller than the one expected (by more than 3 % in the example above) is more important if credit spreads are on the rise in the month preceding the forecast. Similarly, the probability of getting a growth rate much higher than the one expected increases: $P(y>3 \setminus z = 0) = 14.3$ % and $P(y>1.5 \setminus z= 25) = 15.4$ %.

As can be seen from Graph 1, the conditional distribution of the Fed's error forecasts has larger left and right tails when credit spreads rise over the month preceding the forecasts, even if, in average, the error forecasts are close to zero whatever the variation in the credit spreads is. These results are robust to the choice of a different bandwidth h_Y or h_Z as shown in Table 1.

It is interesting to compute the conditional quantile estimators and assess the precision of the estimates. Under a set of conditions on densities and kernels, Henry and Scaillet (2002) establish the asymptotic normality of the conditional quantile estimators (Theorem 2, page 8). More precisely, if Q(z,p) is the "true" conditional quantile estimator, they show that $(Th_Z)^{1/2}\,[\hat{Q}(z,p) - Q(z,p)] / V$ follows a standard normal variable, where V can be estimated by: $\hat{V} = [p(1-p) / f_Z(z)]\ [\hat{f}(\hat{Q}(z,p) / z)]^{-2} \int K^2(u)\, du$, and $\hat{f}(\hat{Q}(z,p) / z)$ is the first derivative of $\hat{F}(y/z)$ with respect to y evaluated at the point $\hat{Q}(z,p)$. The formulae above allow us to compute confidence intervals for the conditional quantile estimator. Note that $\int K^2(u)\, du = 0.2821$ for a Gaussian kernel, and $\int K^2(u)\, du = 9/15$ for an Epanechnikov kernel.

We find $\hat{Q}(z = 0, 0.90) = -3.35$ % (i.e. the conditional quantile at 90 % given z = 0 is -3.35 %), and the confidence interval at 95 %, is given by: [-3.65 %, -3.05 %]. Similarly, we have $\hat{Q}(z = 0.25, 0.90) = -3.85$ %, and the confidence interval at 95 %, is [-4.00, -3.69]. Interestingly, the two confidence intervals do not overlap, which shows that the two conditional quantile estimators are statistically different.

To a certain extent, the results are unchanged if we consider the inflation forecast errors instead of the GDP forecast errors[12]. For example, the probability of overestimating inflation by more than one percent is 16.9 % if credit spreads are flat on the month preceding the forecast, and 18.1 % if they rise by 25 basis points.

Finally, as can be seen from Graph 2, conditioning on stock returns leads to comparable results: the conditional probability distribution function of the inflation forecast errors exhibits fatter tails when the stock market (measured by the performance of the SP500 index on the quarter preceding the FOMC meeting) plunges[13]. This suggests that credit spreads (but also stock returns) give in real-time an indication about the uncertainty – and in particular the downside risks – of the baseline forecast. As we saw in

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[12] Inflation forecast errors are measured by the difference between the “true” inflation rate on the four quarters following the FOMC meeting and the forecast computed for this period.

[13] In the graph, we compare the conditional pdf of the Fed forecast errors for z = 0 % (the stock market is flat on the quarter preceding the FOMC meeting) and z = - 5% (a loss of 5 % on the quarter).

Section 2, this is exactly what happened between September and December 1990: credit spreads surged and the stock market plunged over the period. Eventually, the recession was much more pronounced than expected.

In this sense, reacting to credit spreads (or stock returns) over and beyond their information content on future inflation and future output could be interpreted as an insurance against the increased likelihood of a very costly extreme event. This action might be costly in the short-run in terms of inflation, as monetary conditions may become slightly too accommodative, but this cost is small compared with the huge cost that the economy would pay if an extreme event occurred.

4. Testing for financial stability considerations

a) Methodology

Let us suppose that the Fed sets its interest-rate target according to the simple forward-looking Taylor rule:

$$r_t^* = [\alpha + \beta\,(E_t(\pi_{t+k}) - \pi^*) + \gamma\, E_t(y_{t+l})] \qquad \text{(Equation 1)}$$

π^* is the (fixed) inflation target rate. $E_t(\pi_{t+k})$ is the expected annualized inflation (food and energy excluded) between t and t+k, given the information set at date t. $E_t(y_{t+l})$ is the expected output gap at date t+l given the information set at date t. r is the Fed Funds rate (see Graph 3). By construction, α is the desired nominal rate when both inflation and output are at their target levels and $\alpha - \pi^*$ is the long-run equilibrium real rate. When $\beta>1$, the Fed Funds rate target moves more than one-for-one with (expected) inflation. This feature is desirable because it tends to stabilize inflation: any increase in the inflation rate brings about a larger increase in the desired Fed Funds rate which eventually leads to a higher real interest rate. This increase in the real interest rate restrains aggregate demand and thereby helps to push inflation back down. The central bank is supposed to move gradually toward its target [14] according to the equation:

$$r_t = \rho(L)\, r_t + (1\text{-}\rho(1))\, r_t^* + \phi(L)\, (\text{financial stability})_t + \varepsilon_t \qquad \text{(Equation 2)}$$

ρ is a polynomial in the lag operator with all its roots outside the unit circle. Apart from the financial stability variable, the specification is the same as in Clarida *et al* (2000). As shown by Sack (1998 and 2000), interest-rate smoothing may be optimal in the presence of uncertainties about the true model of the economy or about the parameters of the model. Similarly, it might be optimal in the presence of uncertainties about the true level of the core variables in real-time (Orphanides [1998]). Alternatively, as emphasized by Woodford (1999), interest-rate smoothing might be a way to steer market expectations of future policy moves and thus stabilize inflation and output without requiring aggressive movements in the short-term interest rate[15].

As in Clarida *et al* (2000), the long-run equilibrium real rate is estimated as the real interest rate on the period [1960:1 - 2000:8], which enables us to identify the inflation target π^*. We run a two-stage GMM estimation on the sample [1982:10 - 2000:08] (monthly data). 1982:10 corresponds to the new monetary policy regime when the Fed switched from monetary base targeting to interest-rate targeting (as documented by Clarida *et al* (2000) or Bernanke and Mihov [1998]). The period covers the tenure of Chairmen Volcker and Greenspan.

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14 Different authors pointed out that interest-rate smoothing may be optimal in the presence of uncertainties about the true model of the economy (Sack [2000]), about the accuracy of real-time data (Orphanides [1998]) or about the parameters of the model (Sack). See Sack and Wieland (2000) for an excellent survey of the literature on interest-rate smoothing.

15 One could refer to Sack and Wieland (1999) for an excellent survey of the literature on interest-rate smoothing.

In the remainder of the paper, unless explicitly specified, the financial stability variable is chosen to be the deviations around the mean of the spread between the Baa-bond yields and the yield on 10-year US government bonds (Source: Moody). When it rises, financial stability is endangered (see supra). The spread moves in the range [110 - 383 basis points] on our sample (see Graphs 4 and 5). It increased by 27 basis points right after the 1987 crash. Likewise, the spread picked up by 48 basis points right after the LTCM event (September 1998). This measure of financial stability is obviously influenced by the change in the Fed Funds rate over the month (i.e. a monetary policy easing is likely to lower the credit spreads[16]). In the first years of the sample, the corporate bonds market was less liquid than it is today. Therefore, change in the spreads could not be entirely imputable to revisions in the perception of risks, as they are (for the most part) today (i.e. the change in the spreads could also reflect liquidity considerations). Undoubtedly, this is the main caveat of using this measure.

We prefer to use the Baa yields instead of the Aaa yields since Campbell and Taksler (2002) document that the yield on Aaa bonds (or AAA bonds in the Standard and Poor's classification) is not always reliable. For example, in the financial sector, the data suggest that AAA-rated bonds yielded 30 basis points more than BBB-rated bonds in 1995 and 1996. These authors remove AAAs from their sample. In Section 4, we check the robustness of the result to other measures of financial stability: changes in the Baa/Aaa spread, or the volatility of stock returns.

The output gap is measured assuming a quadratic trend for potential output (i.e. the output gap is estimated as the residual in the regression of the (log) Industrial

[16] In the second chapter of my dissertation, I provide a more complete discussion of the effect of policy rates on credit spreads.

Production Index on a constant, time and time squared)[17]. The main drawback of using this measure is that the industrial sector represents a shrinking component of the US economy. And, at least in the most recent years, growth in the economy as a whole – driven by growth in services – has exceeded growth in industry. Alternative measures could be used instead, such as the deviation around the mean of the capacity utilization rate in industry or the difference between the natural unemployment rate (as computed by the CBO) and the unemployment rate. The first of these alternative measures is subject to the same caveat. Graph 6 compares these output gap measures with the quarterly measure computed by the Congressional Budget Office (CBO).

As in Bernanke and Gertler (1999) and Clarida *et al* (2000), assuming rational expectations, the expectation terms $E_t(\pi_{t+k})$ and $E_t(y_{t+l})$ are replaced in the estimation by the true values π_{t+k} and y_{t+l}. An alternative could have been to use the *Greenbook Forecasts*. However, they are published with a 5-year lag, and the last five years are especially interesting because they encompass several periods of financial instability (the Asian crisis in 1997, the Russian crisis, and the collapse of LTCM in 1998). Since the error term is correlated with the regressors π_{t+k} , y_{t+l} and with the financial stability variable, we run a GMM estimation with a set of instruments known at time t. It encompasses the first three lags of the log-differenced annualized CPI (food and energy excluded), the Fed Funds rate, the output gap and the credit spread. The inflation target is supposed to be fixed. This may be a strong assumption at least if we think that the Fed followed the inflation target published by the Council of Economic Advisors (see Graph

[17] This is also the case in Bernanke and Gertler (1999).

7). However, a structural break test, as the one undertaken in Section 5c, could easily detect how relevant the assumption is.

The first stage GMM is 2SLS. The second stage is run with the optimal weighting matrix: $W_T = S_T^{-1}$, with S_T the variance-covariance matrix of the moment conditions. Given the overlapping nature of the forecast errors[18], the residuals ε_t are likely to have an MA representation. Therefore, we use a heteroskedastic and autocorrelation-consistent variance-covariance matrix (Newey and West [1987]):

$$S_T = S_0 + \sum_{l=1}^{L} w(l)\,(S_l + S_l') \quad \text{with } S_l = (1/T) \sum_{t=l+1}^{T} \varepsilon_t\, \varepsilon_{t-l}\, (Z_t\, Z_{t-l}')$$

ε_t are the first stage estimated residuals, T is the number of observations (T=215), Z is the T*k matrix of the instruments (k= 13), w(l) denotes the Bartlett kernel ($w(l) = 1 - l/(L+1)$) and L is the cut-off point. Thus, with X the T*n matrix of the explanatory variables (n = 6) and y the T*1 vector of the Fed Funds rate, the GMM estimator δ_T is given by:

$$\delta_T = (X'ZW_TZ'X)^{-1}\, X'ZW_TZ'y$$

Its variance can be estimated by: $Var(\delta_T) = T\,(X'ZW_TZ'X)^{-1}$.

In what follows, the benchmark equation is run with k = 12 and l = 0 (forecast one-year ahead for the inflation rate). The cut-off point L is determined using the procedure devised by Andrews (1991). We find: L* = 3. Graph 3 features the principal series.

b) Results

The estimation does not pass the J-test of over-identifying restrictions (Hansen [1982]) for one lag of the Fed Funds rate. That is the reason why, as in Bernanke and Gertler (1999), we use two lags. We select a ϕ polynomial of order 1[19]: therefore, the "add-on" variable (compared with a traditional forward-looking Taylor rule) is: ϕ_0 ($spread_t - s^*$) + ϕ_1 ($spread_{t-1} - s^*$), with s* the mean of credit spreads over the sample. The results are displayed in Table 2.

We confirm the standard result laid out by Clarida *et al* (2000): the response to expected inflation is greater than one. Although over-identifying restrictions are not rejected with L = L*, the J-statistic is smaller when we choose L = 12 [20]. As in Florens, Jondeau and Le Bihan (2001), it might indicate that the residuals are slightly correlated. Moreover, the Fed reacts to the financial stability variable, since the ϕ parameters are statistically significant. Everything else being equal, a 25 basis points rise in the spread between Baa bonds and US 10-year bonds triggers a decrease in the Fed Funds rate of about the same magnitude. This result is robust to the inclusion of an LTCM dummy variable or a crash87 dummy[21].

In an extension of the Rotemberg and Woodford (1997) model, Boivin and Giannoni (2001) estimate the horizon forecasts to be 6 months for the inflation

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18 $\pi t+k$ is the inflation rate between t and t+k, and therefore, the forecast error made for t+k (the error made when we replace Et($\pi t+k$) by $\pi t+k$ in the estimation) is correlated with the forecast error for t+k-1 (the error made when we replace Et-1($\pi t+k-1$) by $\pi t+k-1$), t+k-2, …, t.

19 We check that the main results remain unchanged with a higher polynomial order.

20 In this case, we find J = 3.52.

21 The LTCM dummy is equal to 1 on the last quarter of 1998 and 0 otherwise, the crash87 variable is equal to 1 on the last quarter of 1987 and 0 otherwise.

expectations and 0 for the output gap component on the period [1979:4 - 2002:2]. With this set of horizon forecasts, the results remain unchanged.

The result is also robust to different horizon forecasts for inflation and output. For example, with k=12 and l=12, the ϕ parameters are still statistically significant, although slightly dampened (ϕ_0 = -0.74 [-2.6] and ϕ_1 = 0.51 [1.8]). This robustness to different horizon forecasts for the output gap is crucial: since credit spreads help predict future output gap (see Gertler and Lown [2000] for example), the statistical significance of the credit spreads coefficients in a setting with l=0 could simply reflect the forward-looking behavior of the Fed (reacting to expected level of future output rather than to the current level of this variable).

5. Testing the robustness of the result

Four robustness checks are successively undertaken. First, we test for an omitted variable bias, with the spread variable being correlated with the position in the business cycle (absent in the specification). Second, we check the robustness to other measures of financial stability and output gap. Third, we test for structural breaks and assess whether the constancy of the parameters in the central bank reaction function is a reasonable assumption. Fourth, we test for instrument irrelevance, with lags of credit spreads (used as instruments) being weakly correlated with contemporaneous credit spreads.

a) Allowing the Taylor rule to vary according to the business cycle

Let's assume that the Fed's reaction function depends on the current position in the business cycle (i.e. that it differs in a recession from an expansion). Since the spread variable is correlated with the position in the business cycle (i.e. the spread rises when the economy slows down, as investors assess that more and more companies will not pay back their debts), Equation 2 may suffer from an omitted variable bias: the significance of the financial stability variable could simply reflect the correlation of the spread with the omitted variables.

Indeed, Dolado, Maria-Dolores and Naveira (2001) test the asymmetry of the Fed reaction function (as well as those of Banco de Espana, Banque de France and Bundesbank) regarding the inflation gap (the difference between expected inflation and its target) in a GMM framework. Their main conclusion is that these central banks intervene much more strongly when inflation moves above target than when it moves below[22]. This result tends to confirm the Mishkin/Posen (1997) effect that there might be a “deflationary bias” at work. Using the same technique, Bec, Ben Salem and Collard (2002) find evidence of asymmetric behavior with respect to the output gap for the Fed, the Banque de France and the Bundesbank on the post-1980 period, with these central banks reacting more to negative than to positive output gaps[23]. Gerlach (2000) documents such asymmetric effects in the pre-1980 period for the US. Building on the simple model developed by Svensson (1997), these authors show that such asymmetry is optimal in a framework where the central bank loss function is itself asymmetric (i.e. it puts a larger weight on inflation above target than on inflation below target and/or a larger weight on negative output gaps than on positive output gaps).

In order to circumvent the omitted variable bias, we control for the position in the business cycle by running the following regression:

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[22] The response to expected inflation is higher when inflation is above target than when inflation is below.

$$r_t = \rho(L)\, r_t + (1-\rho(1))\, [\alpha^+ + \alpha^- + \beta^+ (E_t(\pi_{t+k}) - \pi^*_{t+k})^+ + \beta^- (E_t(\pi_{t+k}) - \pi^*_{t+k})^- +$$

$$\gamma^+ E_t(y_{t+l})^+ \gamma^- E_t(y_{t+l})^-] + \phi_0(spread_t - s^*) + \phi_1(spread_{t-1} - s^*) + \varepsilon_t$$

where $x^+ = x$ if $y_{t-1} - y_{t-3} > 0$ and zero otherwise; $x^- = x$ if $y_{t-1} - y_{t-3} < 0$ and zero otherwise. The financial stability parameters are still significant, confirming the previous results (see Table 3). Furthermore, $\beta^+ > \beta^-$, confirming the Mishkin/Posen effect[24]: the Fed pursues an aggressive inflation-targeting strategy in expansions ($\beta^+ = 2.95$).

b) Robustness to other measures of financial stability and to other measures of the output gap

With the spread between Baa bonds and Aaa bonds (see Graphs 4 and 5), the results are largely unchanged (still with k = 12 and l = 0). However, the Fed does not seem to react to the other measures of financial stability that we could think of. In particular, the Fed does not seem to react to stock returns over and beyond their information content on future inflation confirming the Bernanke/Gertler (1999) result. Nor do we see any sign of stock return asymmetry or any reaction to stock market volatility (see results in Table 4).

Finally, the results presented above are robust to the choice of other measures of the output gap (see Table 5). In particular, the reaction to the contemporaneous Baa/Us 10-year spread is –1.18 (t-stat of –5.1) with the deviation of the unemployment rate

23 In other words, the response to expected output gap is higher in recessions (negative output gap) than in booms (positive output gap), the latter coefficient not being statistically different from zero.

24 Note that the Bec *et al* finding is not confirmed on our data.

around the natural unemployment rate[25], and –1.50 (t-stat of –6.7) with the deviation around the mean of the capacity utilization rate in industry.

c) *Is there a breakpoint?*

Some changes that have occurred since 1982 might have prompted a regime change. First, the inflation target was lowered at the beginning of 1986 from 4 % to 3 %[26]. Second, Alan Greenspan took office in August 1987. Third, financial instability concerns have increased in the recent years with the Asian crisis, followed by the Russian crisis and the LTCM bail-out, and, more recently, the collapse of the Nasdaq. These events may cast doubts on the constancy of the parameters in Equation 1.

In a Time-Varying Parameter framework (where the parameters of the model are supposed to follow a random walk), Boivin (2004) documents instability in the Fed reaction function since 1982, with a decreasing response to expected activity and an increasing response to expected inflation. He argues that under Chairman Greenspan, the conduct of monetary policy has evolved closer to a pure inflation-targeting rule. In a random coefficients VAR for inflation, unemployment and the interest rate, Cogley and Sargent (2001) – using Bayesian methods – document that the response to inflation[27] increased in 1981 and kept increasing until the end of Volcker's term. During the first half of Greenspan's term, policy drifted toward a less active stance. But policy has again grown more activist since 1993, surpassing the peak achieved at the end of Volcker's tenure.

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[25] The natural unemployment rate is found in CBO.

[26] According to the survey published by the Council of Economic Advisors (see Dolado et al or Bec et al).

[27] Inflation at time t-1.

In a linear regression framework, several authors (including Bai [1997]) devise econometric tests for detecting unknown breakpoints endogenously. Similarly, in a GMM framework, Ghysels, Guay and Hall (1997) build a test for detecting a potential regime change. The underlying idea of the "Predictive Test" is to divide the sample in two sub-samples around a potential breakpoint candidate and to evaluate the moment conditions for the observations in the second sub-sample at the parameter estimators based on the first sub-sample. Under the null hypothesis of parameter constancy on the whole sample, these estimated moments should be approximately zero. Compared with the traditional tests used in the linear case (such as the Sup-Wald tests), the "Predictive Test" has two caveats. First, it cannot detect multiple breaks, and second, it does not assess the precision of the point estimate (i.e. it is not possible to build confidence intervals around the breakpoint).

We computed the "Predictive Test" on the whole sample and found a breakpoint in August 1993 (with a Sup PR statistic slightly above its critical value at 10 %)[28]. Then, we re-estimated the regression on the period [1982:10 - 1993:08]. The main results remain unchanged. In particular, the financial stability coefficients are still statistically significant[29].

d) Assessment of the GMM methodology: Is there a weak instrument bias?

In the case of a classic forward-looking Taylor rule (where the Fed responds to inflation and output gap expectations but does not respond to a financial stability variable

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[28] The Predictive test statistic is equal to 42.1 on the sample, for a critical value at 10 % of 36.21 (see Ghysels et al [1999]).

[29] The results are: $\pi^* = 3.3$, $\beta = 3.13$ (5.7), $\gamma = 0.21$ (1.7), $\rho 1 = 1.25$ (13.7), $\rho 2 = -0.35$ (-2.0), $\phi 0 = -0.81$ (-2.0) and $\phi 1 = 0.72$ (2.0).

explicitly), Florens, Jondeau and Le Bihan (2001) assess the accuracy of the GMM estimation by Monte-Carlo simulations and by comparing the results with those of an FIML estimation, where the central bank reaction function is estimated jointly with a small model of the economy (i.e. jointly with a Philips and an IS equation). Their main conclusion is that the two-stage GMM methodology – the one used in Bernanke and Gertler (1999) and in our estimation – is slightly biased in finite samples[30].

In our setting, problems may be compounded by the financial stability variable. Lags of this variable (especially when it is measured by stock returns) – chosen as instruments in the estimation – are weakly correlated with current values. More generally, it is hard to find any convincing instrumental variables for credit spreads or current stock returns[31].

In the context of instrumental variable estimators, Nelson and Startz (1990) or Maddala and Jeong (1992) document that the large-sample normal approximation for the estimator works poorly when the instruments have a low correlation with the included endogenous variables. In the GMM framework, Stock and Wright (2000) find a similar phenomenon. Their empirical application to the inter-temporally separable consumption CAPM shows that, because lags of consumption growth and lags of stock returns are weakly correlated with current consumption growth and current stock returns, "inferences

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[30] The two-step GMM estimator tends to slightly over-estimate the central bank's response to expected inflation. The other GMM estimators (continuous-updating GMM and "iterative GMM") seem to perform much less accurately.

[31] One exception is Lettau and Ludvigson (2001) who find that the residuals in the co-integrating relation between labor income, financial wealth and consumption help predict excess stock returns. Rigobon and Sack (2001) circumvent the problem of weak instruments by using a new identification technique based on the heteroskedasticity of stock market returns. The underlying idea stems from the stylized fact that the correlation between stock market returns and short-term interest rates is generally negative at a daily frequency except during periods of high stock return volatility when the correlation becomes positive. This suggests that we should assess the contemporaneous relationship between stock returns and interest rates by

based on conventional GMM methodology are unreliable"[32], even when the J-statistic does not reject the model. Moreover, in the presence of weak instruments, the GMM estimator is biased in finite samples. That is the reason why we would like to confirm the main implication of the previous sections – that the Fed reacts to credit spreads along with expected inflation or the output gap – by simulation methods.

The true data generating process (DGP) of the economy is supposed to be an unrestricted 4 –variable VAR (the inflation rate, output gap, the spread between Baa bonds and US 10-year bonds and the Fed Funds rate) for the first three variables and the forward-looking Taylor rule (Equation 2) estimated by a GMM procedure for the Fed Funds rate[33]. The optimal number of lags (p=3) is selected using the SIC criteria[34].

The reduced form of the 4-equation system is computed by the AIM procedure (Anderson and Moore [1985]). The simulations are led on the reduced form by drawing random shocks according to a bootstrapping procedure. Then, the Fed reaction function (on the model of Equation 2) is computed by a GMM estimation using the set of instruments implied by the simulation[35]. The initial conditions are set equal to the mean of the variables on the sample (which is zero since we are working in demeaned data), and the first 200 observations are discarded to limit the impact of the initial conditions. Furthermore, we discard the simulations for which $\rho_1 + \rho_2 > 0.99$, since estimating the equation when r has a unit root does not make any sense.

estimating the reduced-form VAR on at least two different regimes: periods of low stock market volatility on the one hand and periods of high volatility on the other.

32 Page 1087.

33 The VAR is estimated by OLS.

34 Note that the AIC statistic is minimized for p=6, but we did not select this number of lags in order to save degrees of freedom.

35 The first three lags of the inflation rate, the output gap, the Fed Funds rate and the (first-differenced) spread between Baa and US 10-year bonds.

The results for T=215 observations and 10000 simulations are displayed in Table 6. The main result of this exercise is that the Fed seems to react to credit spreads over and beyond their information content on future inflation: the ϕ parameters are statistically significant.

6. Conclusion

This paper laid out two main results. First, the Fed reacts to credit spreads over and beyond their information content on future inflation and future activity. Second, when credit spreads are on the rise, the probability that the Fed will make a large error in forecasting output increases. In this sense, preemptive easings – despite their short-term costs, as monetary policy may become too accommodative – are a way to take fat tails into account in the conditional distribution of the Fed forecasts (i.e. the downside risks to the baseline forecast) and insure the economy against increasing uncertainty and the likelihood of a very costly extreme event.

These results suggest two different monetary policy regimes: the first corresponds to times when financial stability is at risk (for example, when the spread described above rises drastically), the second in more "normal" times. We could test this assumption using the Hamilton switching regression traditional framework (Hamilton [1989]). This framework would allow for more flexibility than the GMM framework used above in the sense that it would not impose any constraint on the way the central bank reacts to financial stability. In particular, the reaction to the spread variable would no longer have to be linear (satisfying the Bordo and Jeanne [2002] claim that the optimal reaction to asset prices is likely to be non-linear), and the reaction to expected inflation and expected output gap could depend on the regime. This is left for future research.

Beyond their short-term costs, preemptive easings pose the risk of a moral hazard bias: the markets know that, in the case of an emergency, the Fed will come to the rescue and provide liquidity in order to try to prevent financial crises from occurring. This may incite investors to take bigger risks.

Finally, but this is beyond the scope of this paper, financial instability can be addressed by other instruments (banking supervision, for example) so that, in certain circumstances, the trade-off between monetary stability and financial stability would be alleviated, and monetary policy could focus on its main goal which is achieving price stability.

Bibliography

Ahearne Alan, Joseph Gagnon, Jane Haltmaier and Steve Kamin, "Preventing Deflation: Lessons from Japan's Experience in the 1990's", International Finance Discussion Papers, Federal Reserve Board, June 2002.

Anderson, G.A. and G.R.Moore, "A Linear Algebraic Procedure for Solving Perfect Foresight Models", *Economic Letters*, 17, 247-252, 1985.

Andrews, Donald W.K., "Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimation", *Econometrica*, Vol.59 (3), 817-858, 1991.

Andrews, Donald W.K, "Tests for Parameter Instability and Structural Change with Unknown Change Point", *Econometrica*, Vol 61, No 4, 821-856, July 1993.

Bai, Jushan, "Estimation of a Change Point in Multiple Regression Models", *The Review of Economics and Statistics*, 1997.

Bec, Frederique, Melika Ben Salem and Fabrice Collard, "Asymmetries in Monetary Policy Reaction Function", Crest Working Paper, 2002.

Bernanke, Ben and Mark Gertler, "Monetary Policy and Asset Price Volatility", *Economic Review*, Federal Reserve Bank of Kansas City, 17-51 (1999).

Bernanke, Ben and Mark Gertler, "Should Central Banks Respond to Movements in Asset Prices?", *American Economic Review Papers and Proceedings* (2001).

Bernanke, Ben, Mark Gertler and Simon Gilchrist (1999): "The Financial Accelerator in a Quantitative Business Cycle Framework", in Taylor and Woodford, "Handbook of Macroeconomics", Amsterdam: Elsevier Science, North Holland.

Bernanke, Ben and Ilian Mihov, "Measuring Monetary Policy", *Quaterly Journal of Economics,* 113(3), 869-902 (1998).

Boivin Jean, "Hs U.S. Monetary Policy Changed? Evidence from Drifting Coefficients and Real-Time Data", Columbia University Working Paper, January 2004.

Boivin Jean and Marc Giannoni, "Has Monetary Policy Become More Effective?", NBER Working Paper 9459, 2003.

Bordo, Michael D. and Olivier Jeanne, "Boom-Busts in Asset Prices, Economic Instability, and Monetary Policy", NBER Working Paper No 8966 (June 2002).

Borio Claudio, N.Kennedy and S.D.Prowse, "Exploring Aggregate Asset Price Fluctuations Across Countries. Measurements, determinants and monetary policy implications", BIS Economic Papers, No. 40, April 1994.

Borio Claudio and Philip Lowe, "Asset Prices, Financial and Monetary Stability: Exploring the nexus", BIS Working Papers, No 114, 2002.

Campbell John Y., and Glen B.Taksler, "Equity Volatility and Corporate Bond yields", *Journal of Finance, forthcoming* (2002).

Britton, E., Fisher P.G. and Whitley J.D., "The Inflation Report projections: understanding the fan charts", Bank of England Quarterly Bulletin, 38 (1998).

Cecchetti, Stephen G., Hans Genberg, John Lipsky, and Sushil Wadhwani, *Asset Prices and Central Bank Policy*, Geneva Reports on the World Economy, Centre for Economic Policy Research (2000).

Clarida, R., J.Gali, and M.Gertler, "Monetary Policy Rules and Macroeconomic Stability: Evidence and some Theory", *Quaterly Journal of Economics* 115 (2000), 147-180.

Cogley Timothy, Thomas J. Sargent, "Evolving Post-World War II U.S. Inflation Dynamics", NBER Macro annuals, 2002.

Dolado Juan J., Ramon Maria-Dolores and Manuel Naveira, "Asymmetries in Monetary Policy: Evidence for Four Central Banks", CEPR Working Paper No 2441 (2001).

Ferguson Roger W., "Should Financial Stability Be An Explicit Central Bank Objective?", BIS Conference Paper, 2003.

Filardo, Andrew J., "Monetary Policy and Asset Prices", Federal Reserve Bank of Kansas City, *Economic Review*, (Third Quarter 2000).

Florens, Clementine, Eric Jondeau and Herve Le Bihan, "Assessing GMM Estimates of The Federal Reserve Reaction Function", Banque de France, NER #83 (2001).

Gerlach, Stefan "Asymmetric Policy Reactions and Inflation", BIS, mimeo, (2000).

Gertler, Mark and Cara S.Lown (2000), "The Information in the High Yield Bond Spread for the Business Cycle: Evidence and Some Implications", NBER Working Paper 7549.

Ghysels, Eric, Alain Guay and Alastair Hall, "Predictive Tests for Structural Change with Unknown Breakpoint", *Journal of Econometrics* 82 209-233, 1997.

Ghysels, Eric, Alain Guay and Alastair Hall, "Corrigendum to Predictive Tests for Structural Change with Unknown Breakpoint", Journal *of Econometrics* 90, 337-343, 1999.

Goodhart, C. and B.Hofman, "Do Asset Prices Help to Predict Consumer Price Inflation", *The Manchester School Supplement*, 68, pp. 122-40 (2000).

Hansen, L.P., "Large Sample Properties of Generalized Method of Moments Estimator", *Econometrica*, 50(4), 1029-1054 (1982).

Henry Marc and Olivier Scaillet, "Nonparametric Specification Analysis of Dynamic Parametric Models", Columbia University, Discussion Paper # 0102-20, March 2002.

Hilbers P, Lei Q. and L.Zacho, "Real Estate Market Developments and Financial Sector Soundness", IMF Working Paper No 01/29 (2001).

Kindleberger Charles, *Manias, Panics and crashes*, New York Basic Books, 1989.

Lettau, Martin and Sydney Ludvigson, "Consumption, Aggregate Wealth and Expected Stock Returns", *Journal of Finance* 56, 815-49, 2001.

Mishkin, Frederic S., "Asymmetric Information and Financial Crises: A Historical Perspective", in Glenn Hubbard "Financial Markets and Financial Crises", The University of Chicago Press (1991).

Mishkin, Frederic S., "The Transmission Mechanism and the Role of Asset Prices in Monetary Policy", NBER Working Paper (Dec 2001).

Mishkin, F. and Posen, A. "Inflation Targeting: Lessons from Four Countries", Federal Reserve of New York Economic Policy Review, (1997).

Mishkin, F. and Eugene N. White, "U.S. Stock Market Crashes and Their Aftermath: Implications for Monetary Policy", NBER Working Paper 8992, 2002.

Newey, Whitney K., and Kenneth D. West, "A Simple Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", *Econometrica* 55:703-8, 1987.

Peek Joe, Eric S. Rosengren and Geoffrey M.B. Tootell, "Does the Federal Reserve Possess an Exploitable Informational Advantage", *Journal of Monetary Economics*, 50 817-839, (2003).

Rotemberg Julio J., and Michael Woodford, "An Optimization-Based Econometric Framework for the Evaluation of Monetary Policy", *NBER Macroeconomics Annual, 1997.*

Rigobon, Roberto, and Brian Sack, "Measuring the Reaction of Monetary Policy to the Stock Market", NBER Working Paper No. 8350 (July 2001).

Rigobon Roberto, and Brian Sack, "The Impact of Monetary Policy on Asset Prices", NBER Working Paper No 8794 (Feb 2002).

Romer Christina and David Romer, "Federal Reserve Information and the Behavior of Interest-rates", *American Economic Review*, 90 (2000).

Sack Brian, "Uncertainty, Learning and Gradual Monetary Policy", Finance and Economics Discussion Series Working Paper #1998-34, Board of Governors of the Federal Reserve System, 1998.

Sack Brian, "Does the Fed act gradually? A VAR analysis", *Journal of Monetary Economics*, 46, 229-256.

Sack Brian and Volcker Wieland, "Interest-rates Smoothing and Optimal Monetary Policy: a Review of Recent Empirical Evidence", Board of Governors of the Federal Reserve System. Finance and Economics Discussion Series (1999).

Staiger Douglas and James Stock, "Instrumental Variables Regressions With Weak Instruments", *Econometrica*, Vol.65, No 3 (Mai 1997).

Stock James, and Mark Watson, "Forecasting Output and Inflation: the Role of Asset Prices", Working Paper, Princeton University (2001).

Schwarz, Anna J., "Asset Price Inflation and Monetary Policy", NBER Working Paper #9321, 2002.

Stock, J.H., and J.Wright, "GMM with Weak Identification", *Econometrica*, 68(5), 1055-1096, 2000.

Taylor, John B., "Discretion versus Policy Rules in Practice", *Carnegie-Rochester Conference Series on Public Policy* 39, 195-214 (1993).

Woodford Michael, "Optimal Monetary Policy Inertia", NBER Working Paper, 1999.

Table 1

Robustness to the choice of the h_Z bandwidth:

H_Y = 3 %. Epanechnikov kernels K and L.

H_Z (in basis points)	P(Y< -3 / Z = 0) (in %)	P(Y < -3 / Z = 25 bp) (in %)
55	11.99	13.53
45	11.6	14.2
35	10.99	15.94
25	9.95	21.84
15	10.42	35.16

Robustness to the choice of the h_Y bandwidth:

H_Z = 45 basis points. Epanechnikov kernels K and L.

H_Y (in %)	P(Y < -3 / Z = 0) (in %)	P(Y < -3 / Z = 25 bp) (in %)
1	9.6	12.8
2	10.4	13.4
3	11.7	14.2
4	13.7	15.8
5	16.4	18.0

Table 2

	K = 12; l = 0
π^*	2.60
β	2.48 (6.3)
γ	0.31 (4.2)
ρ_1	1.25 (15.5)
ρ_2	-0.32 (-4.4)
ϕ_0	-1.05 (-4.6)
ϕ_1	0.95 (4.3)
J	3.8 (p-value = 0.82)

Table 3

	K = 12; l = 0
β^+	2.95 (2.2)
β^-	2.16 (4.1)
γ^+	0.45 (1.0)
γ^-	-0.05 (-0.1)
ρ_1	1.24 (14.9)
ρ_2	-0.30 (-4.1)
ϕ_0	-1.09 (-2.3)
ϕ_1	0.89 (2.4)
J	2.1 (p-value = 0.95)

Table 4

	Baa/Aaa spread	Stock returns[36]	Stock returns asymmetry[37]	Stock market volatility[38]
π^*	2.9	3.01	2.82	2.63
β	3.07 (4.8)	2.73 (7.5)	2.83 (4.2)	2.5 (7.1)
γ	0.30 (4.7)	0.25 (5.2)	0.26 (2.6)	0.27 (6.1)
ρ_1	1.19 (18.7)	1.18 (10.7)	1.17 (8.6)	1.23 (21.9)
ρ_2	-0.27 (-4.2)	-0.37 (-4.0)	-0.33 (-1.8)	-0.32 (-5.8)
ϕ_0	-1.43 (-2.6)			-0.04 (-0.6)
ϕ_1	1.26 (2.5)			
θ		0.016 (1.2)	0.024 (0.4)	
λ			-0.015 (-0.2)	
J	10.24 (p = 0.17)	3.83 (p = 0.80)	2.8 (p = 0.90)	13.3 (p = 0.07)

36 In this specification, the financial stability variable is: $\theta_0 s_t + \theta_1 s_{t-1} + \theta_2 s_{t-2} + \theta_3 s_{t-3} + \theta_4 s_{t-4} + \theta_5 s_{t-5}$, where s_t is the stock return on month t, and the reported θ parameter is the sum of the six coefficients.

37 In this specification, the financial stability variable is: $\theta (s_t + s_{t-1} + s_{t-2} + s_{t-3} + s_{t-4} + s_{t-5}) + \lambda\, 1(s_t + s_{t-1} + s_{t-2} + s_{t-3} + s_{t-4} + s_{t-5} > 0)$. The first six lags of stock returns are used as instruments. L* = 10.

38 In this specification, the financial stability variable is the change in the volatility on the quarter: $volat_t - volat_{t-3}$ The first three lags of $\Delta volat_t$ are used as instruments. L* = 3. The volatility is computed as the (annualized) standard deviation of the 40 daily returns preceding the last day of month t.

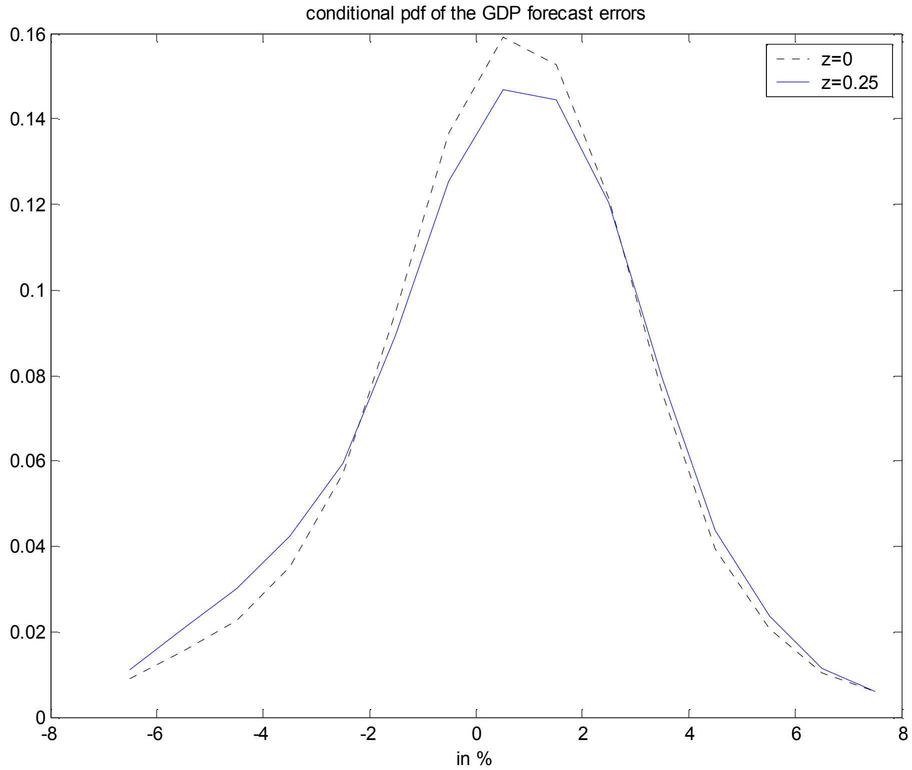
Table 5

	Capacity Utilization rate	Natural unemployment rate-unemployment rate
π^*	3.4	2.2
β	2.11 (2.0)	1.81 (1.5)
γ	0.55 (0.9)	1.68 (1.2)
ρ_1	1.33 (17.6)	1.32 (19.7)
ρ_2	-0.36 (-4.8)	-0.34 (-5.1)
ϕ_0	-1.50 (-6.7)	-1.18 (-5.1)
ϕ_1	1.36 (6.6)	1.05 (5.0)
J	4.4 (p = 0.76	5.8 (p = 0.60)

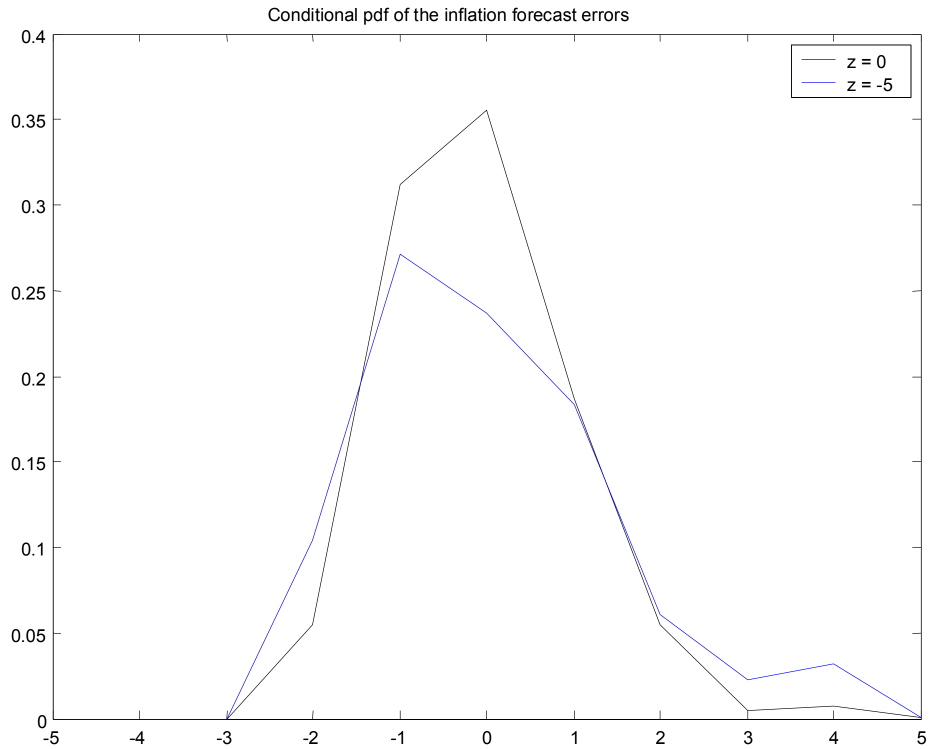
Table 6

	Mean	Median	t-stat	5 %-prctile	95 % percentile	Median of squared deviations around the median
β	2.03	2.32	1.3	-0.58	3.53	0.26
γ	0.29	0.29	1.8	0.10	0.50	0.003
ρ_1	1.22	1.23	11.1	1.02	1.37	0.004
ρ_2	-0.3	-0.31	-3.8	-0.43	-0.18	0.003
ϕ_0	-0.98	-0.98	-3.3	-1.47	-0.51	0.04
ϕ_1	0.79	0.78	2.8	0.36	1.25	0.03

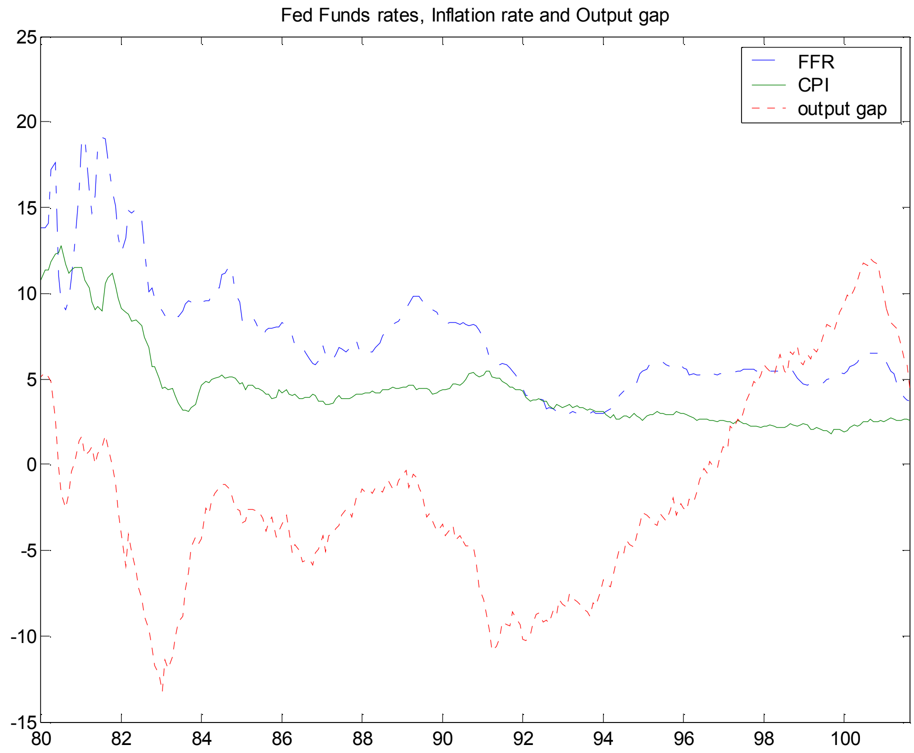
Graph 1


conditional pdf of the GDP forecast errors
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-8
-6
-4
-2
0
2
4
6
8
in %
z=0
z=0.25

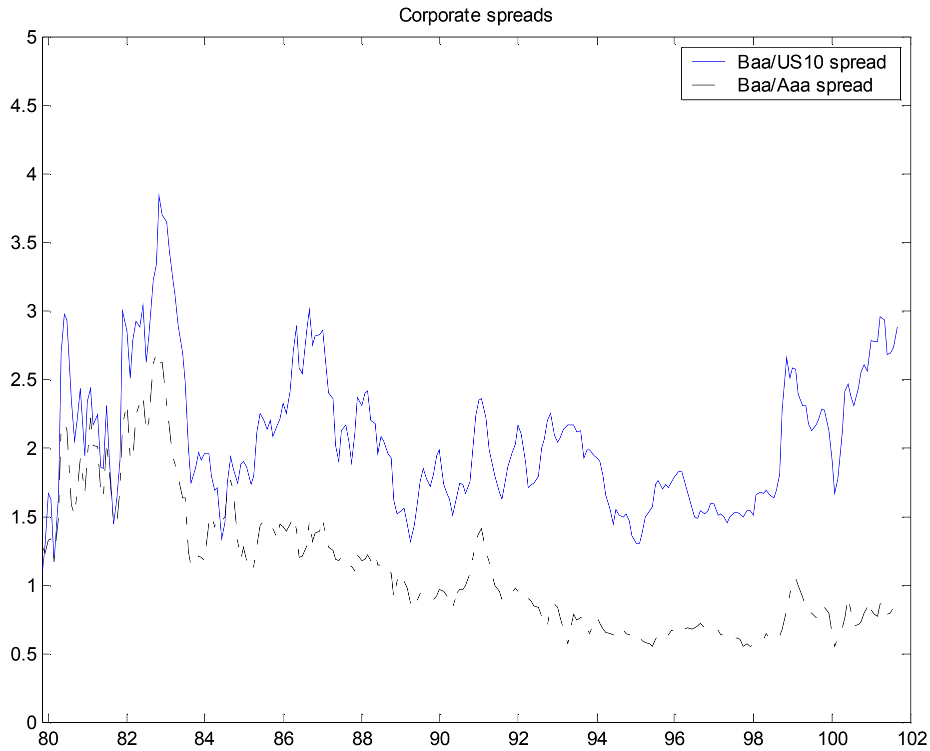
Graph 2


Conditional pdf of the inflation forecast errors
z = 0
z = -5
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-5
-4
-3
-2
-1
0
1
2
3
4
5

Graph 3

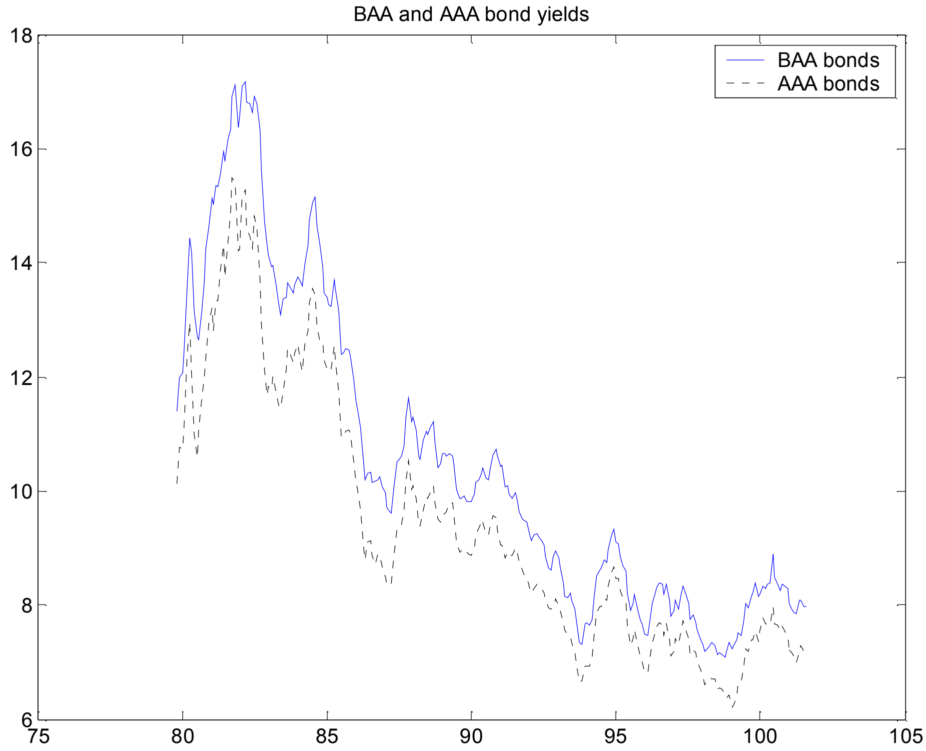

Fed Funds rates, Inflation rate and Output gap
FFR
CPI
output gap
25
20
15
10
5
0
-5
-10
-15
80
82
84
86
88
90
92
94
96
98
100

Graph 4



Corporate spreads
Baa/US10 spread
Baa/Aaa spread
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
80
82
84
86
88
90
92
94
96
98
100
102

Graph 5

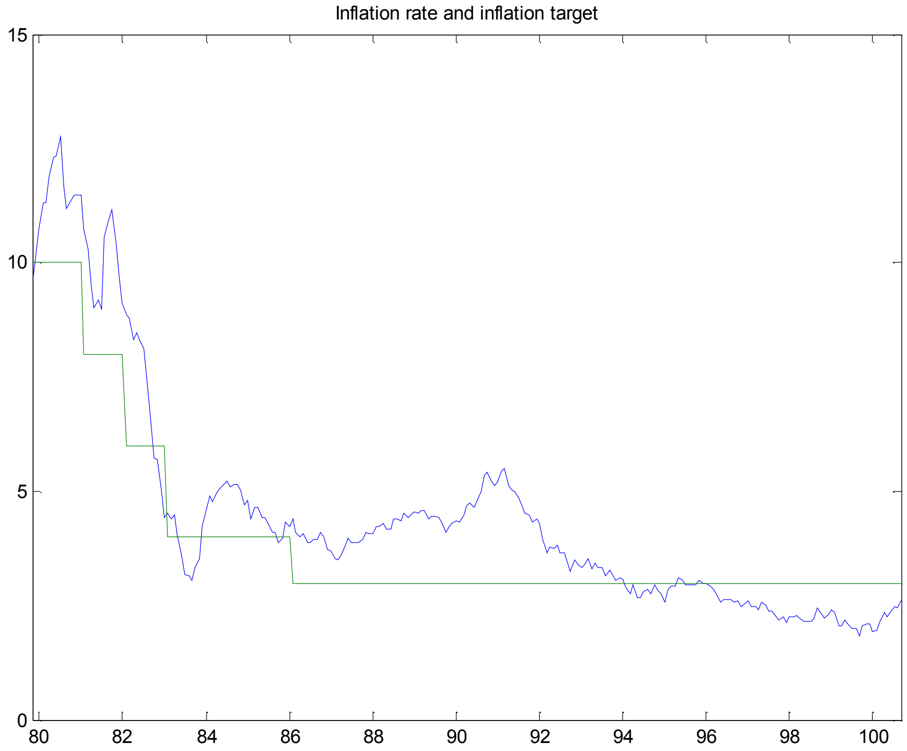


BAA and AAA bond yields
BAA bonds
AAA bonds
18
16
14
12
10
8
6
75
80
85
90
95
100
105

Graph 6

Output gap: Different Measures
15
10
5
0
-5
-10
-15
80
85
90
95
100
105
cbo
gali
capac

Graph 7


Inflation rate and inflation target
15
10
5
0
80
82
84
86
88
90
92
94
96
98
100

Notes d'Études et de Recherche

1. C. Huang and H. Pagès, “Optimal Consumption and Portfolio Policies with an Infinite Horizon: Existence and Convergence,” May 1990.

2. C. Bordes, « Variabilité de la vitesse et volatilité de la croissance monétaire : le cas français », février 1989.

3. C. Bordes, M. Driscoll and A. Sauviat, “Interpreting the Money-Output Correlation: Money-Real or Real-Real?,” May 1989.

4. C. Bordes, D. Goyeau et A. Sauviat, « Taux d'intérêt, marge et rentabilité bancaires : le cas des pays de l'OCDE », mai 1989.

5. B. Bensaid, S. Federbusch et R. Gary-Bobo, « Sur quelques propriétés stratégiques de l'intéressement des salariés dans l'industrie », juin 1989.

6. O. De Bandt, « L'identification des chocs monétaires et financiers en France : une étude empirique », juin 1990.

7. M. Boutillier et S. Dérangère, « Le taux de crédit accordé aux entreprises françaises : coûts opératoires des banques et prime de risque de défaut », juin 1990.

8. M. Boutillier and B. Cabrillac, “Foreign Exchange Markets: Efficiency and Hierarchy,” October 1990.

9. O. De Bandt et P. Jacquinot, « Les choix de financement des entreprises en France : une modélisation économétrique », octobre 1990 (English version also available on request).

10. B. Bensaid and R. Gary-Bobo, “On Renegotiation of Profit-Sharing Contracts in Industry,” July 1989 (English version of NER n° 5).

11. P. G. Garella and Y. Richelle, “Cartel Formation and the Selection of Firms,” December 1990.

12. H. Pagès and H. He, “Consumption and Portfolio Decisions with Labor Income and Borrowing Constraints,” August 1990.

13. P. Sicsic, « Le franc Poincaré a-t-il été délibérément sous-évalué ? », octobre 1991.

14. B. Bensaid and R. Gary-Bobo, “On the Commitment Value of Contracts under Renegotiation Constraints,” January 1990 revised November 1990.

15. B. Bensaid, J.-P. Lesne, H. Pagès and J. Scheinkman, “Derivative Asset Pricing with Transaction Costs,” May 1991 revised November 1991.

16. C. Monticelli and M.-O. Strauss-Kahn, “European Integration and the Demand for Broad Money,” December 1991.

17. J. Henry and M. Phelipot, “The High and Low-Risk Asset Demand of French Households: A Multivariate Analysis,” November 1991 revised June 1992.

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20. A. de Palma, L. Leruth and P. Régibeau, “Partial Compatibility with Network Externalities and Double Purchase,” August 1992.

21. A. Frachot, D. Janci and V. Lacoste, “Factor Analysis of the Term Structure: a Probabilistic Approach,” November 1992.

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23. M. Jeanblanc-Picqué and R. Avesani, “Impulse Control Method and Exchange Rate,” September 1993.

24. A. Frachot and J.-P. Lesne, “Expectations Hypothesis and Stochastic Volatilities,” July 1993 revised September 1993.

25. B. Bensaid and A. de Palma, “Spatial Multiproduct Oligopoly,” February 1993 revised October 1994.

26. A. de Palma and R. Gary-Bobo, “Credit Contraction in a Model of the Banking Industry,” October 1994.

27. P. Jacquinot et F. Mihoubi, « Dynamique et hétérogénéité de l'emploi en déséquilibre », septembre 1995.

28. G. Salmat, « Le retournement conjoncturel de 1992 et 1993 en France : une modélisation VAR », octobre 1994.

29. J. Henry and J. Weidmann, “Asymmetry in the EMS Revisited: Evidence from the Causality Analysis of Daily Eurorates,” February 1994 revised October 1994.

30. O. De Bandt, “Competition Among Financial Intermediaries and the Risk of Contagious Failures,” September 1994 revised January 1995.

31. B. Bensaid et A. de Palma, « Politique monétaire et concurrence bancaire », janvier 1994 révisé en septembre 1995.

32. F. Rosenwald, « Coût du crédit et montant des prêts : une interprétation en terme de canal large du crédit », septembre 1995.

33. G. Cette et S. Mahfouz, « Le partage primaire du revenu : constat descriptif sur longue période », décembre 1995.

34. H. Pagès, “Is there a Premium for Currencies Correlated with Volatility? Some Evidence from Risk Reversals,” January 1996.

35. E. Jondeau and R. Ricart, “The Expectations Theory: Tests on French, German and American Euro-rates,” June 1996.

36. B. Bensaid et O. De Bandt, « Les stratégies “stop-loss” : théorie et application au Contrat Notionnel du Matif », juin 1996.

37. C. Martin et F. Rosenwald, « Le marché des certificats de dépôts. Écarts de taux à l'émission : l'influence de la relation émetteurs-souscripteurs initiaux », avril 1996.

38. Banque de France - CEPREMAP - Direction de la Prévision - Erasme - INSEE - OFCE, « Structures et propriétés de cinq modèles macroéconomiques français », juin 1996.

39. F. Rosenwald, « L'influence des montants émis sur le taux des certificats de dépôts », octobre 1996.

40. L. Baumel, « Les crédits mis en place par les banques AFB de 1978 à 1992 : une évaluation des montants et des durées initiales », novembre 1996.

41. G. Cette et E. Kremp, « Le passage à une assiette valeur ajoutée pour les cotisations sociales : Une caractérisation des entreprises non financières “gagnantes” et “perdantes” », novembre 1996.

42. S. Avouyi-Dovi, E. Jondeau et C. Lai Tong, « Effets “volume”, volatilité et transmissions internationales sur les marchés boursiers dans le G5 », avril 1997.

43. E. Jondeau et R. Ricart, « Le contenu en information de la pente des taux : Application au cas des titres publics français », juin 1997.

44. B. Bensaid et M. Boutillier, « Le contrat notionnel : efficience et efficacité », juillet 1997.

45. E. Jondeau et R. Ricart, « La théorie des anticipations de la structure par terme : test à partir des titres publics français », septembre 1997.

46. E. Jondeau, « Représentation VAR et test de la théorie des anticipations de la structure par terme », septembre 1997.

47. E. Jondeau et M. Rockinger, « Estimation et interprétation des densités neutres au risque : Une comparaison de méthodes », octobre 1997.

48. L. Baumel et P. Sevestre, « La relation entre le taux de crédits et le coût des ressources bancaires. Modélisation et estimation sur données individuelles de banques », octobre 1997.

49. P. Sevestre, “On the Use of Banks Balance Sheet Data in Loan Market Studies : A Note,” October 1997.

50. P.-C. Hautcoeur and P. Sicsic, “Threat of a Capital Levy, Expected Devaluation and Interest Rates in France during the Interwar Period,” January 1998.

51. P. Jacquinot, « L’inflation sous-jacente à partir d’une approche structurelle des VAR : une application à la France, à l’Allemagne et au Royaume-Uni », janvier 1998.

52. C. Bruneau et O. De Bandt, « La modélisation VAR structurel : application à la politique monétaire en France », janvier 1998.

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56. E. Jondeau and M. Rockinger, "Estimating Gram-Charlier Expansions with Positivity Constraints," January 1999.

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71. R. Lacroix, "Testing for Zeros in the Spectrum of an Univariate Stationary Process: Part II," December 1999.

72. R. Lacroix, "Testing the Null Hypothesis of Stationarity in Fractionally Integrated Models," December 1999.

73. F. Chesnay and E. Jondeau, "Does correlation between stock returns really increase during turbulent period?," April 2000.

74. O. Burkart and V. Coudert, “Leading Indicators of Currency Crises in Emerging Economies,” May 2000.

75. D. Irac, “Estimation of a Time Varying NAIRU for France,” July 2000.

76. E. Jondeau and H. Le Bihan, “Evaluating Monetary Policy Rules in Estimated Forward-Looking Models: A Comparison of US and German Monetary Policies,” October 2000.

77. E. Jondeau and M. Rockinger, “Conditional Volatility, Skewness, ans Kurtosis: Existence and Persistence,” November 2000.

78. P. Jacquinot et F. Mihoubi, « Modèle à Anticipations Rationnelles de la COnjoncture Simulée : MARCOS », novembre 2000.

79. M. Rockinger and E. Jondeau, “Entropy Densities: With an Application to Autoregressive Conditional Skewness and Kurtosis,” January 2001.

80. B. Amable and J.-B. Chatelain, “Can Financial Infrastructures Foster Economic Development? ,” January 2001.

81. J.-B. Chatelain and J.-C. Teurlai, “Pitfalls in Investment Euler Equations,” January 2001.

82. M. Rockinger and E. Jondeau, “Conditional Dependency of Financial Series: An Application of Copulas,” February 2001.

83. C. Florens, E. Jondeau and H. Le Bihan, “Assessing GMM Estimates of the Federal Reserve Reaction Function,” March 2001.

84. J.-B. Chatelain, “Mark-up and Capital Structure of the Firm facing Uncertainty,” June 2001.

85. B. Amable, J.-B. Chatelain and O. De Bandt, “Optimal Capacity in the Banking Sector and Economic Growth,” June 2001.

86. E. Jondeau and H. Le Bihan, “Testing for a Forward-Looking Phillips Curve. Additional Evidence from European and US Data,” December 2001.

87. G. Cette, J. Mairesse et Y. Kocoglu, « Croissance économique et diffusion des TIC : le cas de la France sur longue période (1980-2000) », décembre 2001.

88. D. Irac and F. Sédillot, “Short Run Assessment of French Economic Activity Using OPTIM,” January 2002.

89. M. Baghli, C. Bouthevillain, O. de Bandt, H. Fraisse, H. Le Bihan et Ph. Rousseaux, « PIB potentiel et écart de PIB : quelques évaluations pour la France », juillet 2002.

90. E. Jondeau and M. Rockinger, “Asset Allocation in Transition Economies,” October 2002.

91. H. Pagès and J.A.C. Santos, “Optimal Supervisory Policies and Depositor-Preferences Laws,” October 2002.

92. C. Loupias, F. Savignac and P. Sevestre, “Is There a Bank Lending Channel in France? Evidence from Bank Panel Data,” November 2002.

93. M. Ehrmann, L. Gambacorta, J. Martínez-Pagés, P. Sevestre and A. Worms, “Financial Systems and The Role in Monetary Policy Transmission in the Euro Area,” November 2002.

94. S. Avouyi-Dovi, D. Guégan et S. Ladoucette, « Une mesure de la persistance dans les indices boursiers », décembre 2002.

95. S. Avouyi-Dovi, D. Guégan et S. Ladoucette, "What is the Best Approach to Measure the Interdependence between Different Markets? ," December 2002.

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97. J.-B. Chatelain, A. Generale, I. Hernando, U. von Kalckreuth and P. Vermeulen, "Firm Investment and Monetary Policy Transmission in the Euro Area," December 2002.

98. J.-S. Mésonnier, « Banque centrale, taux de l'escompte et politique monétaire chez Henry Thornton (1760-1815) », décembre 2002.

99. M. Baghli, G. Cette et A. Sylvain, « Les déterminants du taux de marge en France et quelques autres grands pays industrialisés : Analyse empirique sur la période 1970-2000 », janvier 2003.

100. G. Cette and Ch. Pfister, "The Challenges of the "New Economy" for Monetary Policy," January 2003.

101. C. Bruneau, O. De Bandt, A. Flageollet and E. Michaux, "Forecasting Inflation using Economic Indicators: the Case of France," May 2003.

102. C. Bruneau, O. De Bandt and A. Flageollet, "Forecasting Inflation in the Euro Area," May 2003.

103. E. Jondeau and H. Le Bihan, "ML vs GMM Estimates of Hybrid Macroeconomic Models (With an Application to the "New Phillips Curve")," September 2003.

104. J. Matheron and T.-P. Maury, "Evaluating the Fit of Sticky Price Models," January 2004.

105. S. Moyen and J.-G. Sahuc, "Incorporating Labour Market Frictions into an Optimising-Based Monetary Policy Model," January 2004.

106. M. Baghli, V. Brunhes-Lesage, O. De Bandt, H. Fraisse et J.-P. Villetelle, « MASCOTTE : Modèle d'Analyse et de préviSion de la COnjoncture TrimesTriellE », février 2004.

107. E. Jondeau and M. Rockinger, "The Bank Bias: Segmentation of French Fund Families," February 2004.

108. E. Jondeau and M. Rockinger, "Optimal Portfolio Allocation Under Higher Moments," February 2004.

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