Dynamic Effects of Credit Shocks in a Data-Rich Environment*

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Abstract

The recent financial crisis and the ensuing global economic downturn suggests that financial variables can predict future economic conditions and play an important role in propagating economic fluctuations. In this paper we examine the dynamic effects and the propagation of credit shocks using a large data set of U.S. economic and financial indicators in a structural factor model. An identified credit shock, which can be interpreted as a unexpected deterioration of the credit market conditions, increases immediately the credit spreads, decreases the interest rates and causes large and persistent downturns in the activity of many economic sectors. In contrast to other recent papers, our approach does not rely on any constructed measure of credit market conditions from a large set of individual bond prices and financial series, and does not require any timing restrictions between the financial factors and the real economic activity. Moreover, our structural shock identification procedure gives an interpretation of the estimated factors.

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1 Introduction

The recent financial crisis caused the most important global economic downturn since the Great Depression. It also generated a new wave of interest in research on the information content of financial series. First, researchers are interested in the forecasting power of financial indicators, and their capability to predict economic downturns. Second, assuming the existence of financial frictions and transmission mechanism à la Bernanke, Gertler and Gilchrist (1999), a particular attention is paid to their role in propagating economic fluctuations.

The forward-looking nature of financial asset prices and credit spreads should be useful in predicting the economic activity, at least theoretically (see Philippon (2008)). Studies, among others, by Stock and Watson (1989), Gertler and Lown (1999), and more recently by Mueller (2007), have found that the credit spreads do have some significant forecasting power in predicting the economic growth. Instead of relying on the usual credit spreads measures, a recent paper by Gilchrist, Yankov and Zakrajsek (2009) re-examines this evidence using a set of new measures of credit market tightness. These credit spreads are constructed directly from a large panel of secondary bond prices on unsecured corporate debt issued by nearly one thousand U.S. nonfinancial firms. When predicting the growth of two real economic activity indicators, they find their constructed portfolio of credit spreads outperform the standard default-risk indicators at horizons longer than two months.

Besides determining the forecasting power of financial series, there is a growing literature on identifying the credit shocks in empirical reduced-form models, and modeling such shocks in general equilibrium models. In Gilchrist, Yankov and Zakrajsek (2009), the authors employ a factor-augmented vector autoregression (FAVAR) model to identify a credit shock, and to investigate its effect on economic and financial series of interest. According to their results, the credit shock, interpreted as an unexpected increase in bond spreads, generates large and persistent contractions in economic activity. Moreover, these disturbances account for a significant fraction of the volatility in U.S. economic activity. In the appendix of Mueller (2007), the author used a structural VAR model with recursive ordering on logs of GDP and CPI, short rate and a credit spread (10-year B-spread). He found that a shock on B-spread causes a significant downturn in economic activity.

Finally, the credit risk and its influence on economic conditions are modeled in the general equilibrium framework. Building on Bernanke, Gertler and Gilchrist (1999), Gilchrist, Ortiz and Zakrajsek (2009) aim to quantify the role of financial frictions in the business cycle fluctuations. They augment a standard DSGE model with the financial accelerator mechanism that links the conditions on the credit market to the real economy through the external finance premium. Two financial shocks are introduced: financial disturbance shock, that affects external finance premium, and net worth shock affecting the balance sheet of a firm. The first shock is presented as a credit supply shock, that Christiano, Motto and Rostagno (2009) interpret as an increase in the agency costs due to a higher variance of idiosyncratic shocks affecting the firm's profitability. The second shock can be viewed as a credit demand shock, and its effect will depend on the degree of financial market frictions. After estimating the structural model, authors find that both financial shocks cause an increase in external finance premium that, through the financial accelerator, implies a slowdown in economic activity.

In this paper, we re-examine the evidence on the propagation mechanism of credit shocks to economic activity. Using large U.S. monthly and quarterly panels, we measure the dynamic effects of credit shocks in a structural factor framework. To identify the structural shocks we do not include any observed factors, nor construct an interpretable subset of factors that are used to achieve the identification. The structural factor model is estimated in two steps. First, the factors are simply calculated as principal components from standardized data panels, and their objective is to recover the space spanned by structural shocks. Then, a finite order VAR approximation of factors dynamics is estimated. The identification of structural shocks is achieved by imposing a recursive structure on the impact matrix of the structural MA representation of observable variables.

Our results show that an unexpected increase in the external finance premium generates a significant and persistent economic slowdown. Since we do not impose timing restrictions on forward-looking variables, these leading indicators respond, as expected, negatively on impact. This gives a more realistic picture of the effect of credit shocks on economy, and informs about the transmission mechanism of these shocks. According to R^2 results, the common component explains a sizeable fraction of the variability in observable series. Hence, the extracted factors capture an important dimension of the business cycle movements. From the variance decomposition analysis, we observe that the credit shock has an important effect on several real activity measures, price indicators, leading indicators, and credit spreads. Finally, a by-product of our identification approach is a rotation matrix that can be used to recover the structural factors. They still have the same informational content, but their interpretation, in terms of the correlation structure, can change. Indeed, we find that the rotated principal components do have an economic interpretation.

These findings are robust to different data frequencies and identification schemes. In the first exercise, we use a monthly balanced panel, and impose the recursive Wald causality scheme as in the structural VAR benchmark model, that results in a model with 4 factors. The results are qualitatively similar to those from the VAR model. However, the factor model gives a more complete and comprehensive picture since the impulse responses and the variance decomposition of all variables can be obtained. We mentioned above that our approach produces interpretable factors. Indeed, the first rotated factor accounts for almost all variation in prices, that is explained by the common component. The second factor is important for unemployment rate, M1, capacity utilization rate, consumer expectations and credit spread. The third rotated factor explains well financial indicators and exchange rate, while the fourth factor explains real activity measures, housing starts and new orders.

In the second specification, we consider a mixed-frequencies monthly panel constructed as in Boivin, Giannoni and Stevanovic (2009), and a recursive identification scheme where we explicitly distinguish between the monetary policy and credit shocks. The model contains 5 factors. The results are similar to the previous specification. Note that in this identification strategy, the impact responses of interest rates are not restricted any more. Indeed, they respond negatively and significatively on impact. Again, we obtain interpretable factors. The first factor is important for price series, and the second explains well the variablity in unemployment rate, money base measures, credit spread and capacity utilization. The third factor seems to be important for consumption series, GDP and investment, the fourth factor contributes mainly in explaining the variations in commodity price index and salaries, and the fifth factor is related to industrial production, employment and new orders.

Lastly, we consider a quarterly balanced panel and identify the structural shocks using the sign restrictions scheme. The dynamic effects of the credit shock are quite similar to what we have observed in previous specifications. The first factor is important for price series, FFR and treasury bills, and the second explains mostly the real activity measures such as GDP, industrial production, employment, salaries and consumption, and housing starts, new orders and consumer credit. The third and fourth factors seem to be important for monetary measures and exchange rate. Finally, the fifth factor is related to unemployment rate (together with the third factor), capacity utilization rate, and average unemployment duration.

In the rest of the paper, we first present the theoretical framework in which credit shocks can occur. Then, we conduct a structural VAR analysis to assess the effects of increases in credit spreads to some economic variables. In Section 4 we present the structural factor model, and discuss the estimation and identification issues. The main results are presented in Section 5, followed by a conclusion. The Appendix contains the impulse response results after a monetary policy shock and the description of data sets.

2 Theory

In this section we shortly discuss how the financial and economic sides are connected, and through which channel(s) the shocks on the credit market could affect economic activity.

2.1 Financial accelerator mechanism and external finance premium

The financial frictions are crucial when linking the credit market conditions to economic activity. In that case, the composition of the borrowers' net worth becomes important due to the incentive problems faced by the lenders (see Bernanke and Gertler (1995), and Bernanke, Gertler and Gilschrist (1999)). If the borrower's net worth is low relatively to the amount borrowed, he has a higher incentive to default. Given that agency problem, the lender demands a higher premium to provide external funds, which rises the external finance premium. Therefore, the economic downturns and declines in asset values, produce an increase in the external finance premium for a borrower having these assets in his portfolio. The higher external finance premium, in turn, leads to cuts in investments, and hence in production, employment, and in the rest of the economic activity, that induces asset prices to fall, and so on. This is essentially the so-called financial accelerator mechanism. Several other transmission channels, focusing on the credit supply, have been introduced in the literature. The narrow credit channel focus on the health of the financial intermediaries and their agency problems in raising funds. The capital channel can transmit credit conditions to the economic activity, if banks' capital is affected. In that case, they must reduce the supply of loans, resulting in a higher external finance premium. To resume, Bernanke and Gertler (1995) identify two channels through which a shock to the external finance premium can affect the real activity:

1. *Balance sheet channel*
   Affecting directly the external finance premium of a firm which can affect investment, inventories, employment, production, prices. This focus on demand of credit.
2. *Bank lending channel*
   If the external finance premium of a bank deteriorates, it can affect the supply of loans and cause some effects on real activity.

The usual proxies of the external finance premium of borrowers are the credit spreads, while in the case of bank lending channel the measures are Ted spreads. Hence, in principle, we could distinguish between the shocks affecting the demand and the supply of loans. In addition, the external finance premium of a firm is determined by the strength of the borrower's financial position (net worth, liquidity, cash flows, etc.), and hence is function of endogenous determinants: net worth, liquidity, cash flows, etc.; exogenous determinants: degree of financial market frictions, supply of loans, regulation, etc.; and is affected by several shocks: monetary policy, demand, supply, and now by financial shocks.

Another remark concerns the empirical proxies of external finance premium and the identification of the structural shocks in a VAR model. Since these are spreads, i.e. differences between bond yields and risk-free rates, their fluctuations can be caused by both components. For example, an expectation of higher default rates should be reflected in widening credit spreads, not rising risk-free rates. Conversely, a positive monetary shock affects mainly the short-term interest rates and not credit spreads. Similarly, demand and supply shocks can have different impacts on the endogenous and exogenous determinants of the external finance premium. Thus, if we want to use a credit spread as proxy for the external finance premium, and want to identify a financial shock as a deterioration of the borrower's financial position, it is important to control for other types of shocks that can affect it, such as monetary policy shock, supply shock and demand shock. Moreover, we need to distinguish between the two channels affecting real economy: balance sheet channel (channel of interest) and bank lending channel. Hence, in a VAR analysis we should include, at least, a real activity measure, an inflation measure, a monetary policy instrument, a credit spread and a Ted spread.

2.2 Empirical proxies

To conduct a VAR analysis we first need to find proxies of the external finance premium for both propagation channels. The usual measures for the balance sheet channel are credit spreads. Our benchmark measure will be the 10-year B-spread, and the alternatives are 10-year A-spread and 1-year B-spread. For the bank lending channel we use 3-month Ted spread. Table 1 and Figure 1 summarize these measures.

3 Structural VAR analysis

In this section, we perform a structural VAR analysis to study the empirical identification of the credit shock and its dynamic effect on economic activity. Our benchmark model is $[\pi_t, UR_t, R_t, 10yBS_t]$ where π_t is the inflation rate calculated as the first difference of logs of CPI, UR_t is the unemployment rate, R_t is the Federal funds rate and $10yBS_t$ is the 10-year B-spread. The time span is 1986M01 - 2008M10, since we consider versions of this VAR with Ted spread, that is available only for this particular period. We impose the recursive identification and several ordering are studied. Moreover, the robustness check of this specification is done by adding other real activity variables, and changing the credit spread measures. For the alternative models we use IP_t (industrial production), $3mTS_t$ (3-month Ted spread), $1yBS_t$ (1-year B-spread) and $10yAS_t$ (10-year A-spread). Table 2 lists all models.

Figure 2 shows the effect of a 100 base points shock to 10-year B-spread in our benchmark VAR model. We can see that a shock increasing the credit spread, causes a significant and persistent economic downturn. However, we didn't control for the bank lending channel and we assumed that the monetary policy authority does not observe (not react immediately to) the shock on the credit spread. In Figure 3 we present results of Models 2 through 6 in which we essentially try different ordering, include Ted spread and other credit spreads. We conclude that results obtained in the benchmark model are robust to the inclusion of Ted spread and to the recursive assumption between the 10-year B-spread and Ted spread, and to the use of other credit spreads.

In Figure 4 we present impulse responses to credit spread from Model 1 where we include the industrial production as another real activity measure. The results are still robust, and the shock on the credit spread generates a persistent slowdown in economic activity.

Lastly, we estimate the Model 7, and identify a shock on the Ted spread to check if an unexpected increase in the external finance premium of financial intermediaries has a significant effect on economy through the bank lending channel. The impulse responses are plotted in Figure 5. The results suggest that such shocks are not persistent, Ted spread attains its steady state value after only 6 months, and they do not cause any significant effect on economic activity. Table 3 contains variance decomposition results to see the contribution of the credit shock to the total variance. It follows that the credit shock has a small effect on CPI and industrial production, a moderate effect on unemployment rate, up to 17.5 percent, and explains up to 53.4 percent of the forecasting error in FFR.

Overall, using structural VAR analysis we have identified some persistent and significant effects on economic activity, that are caused by an increase of firms' external finance premium. Given that we have controlled for other shocks that can increase the external finance premium, we can interpret these results as an evidence of credit market shocks affecting the economic activity through the financial accelerator mechanism and credit transmission channels.

4 Econometric framework in data-rich environment

In previous section, we tried to identify the credit shock using standard VAR techniques with recursive identification schemes. However, as pointed out in Bernanke, Boivin and Eliasz (2005), the small-scale VAR model presents three issues. Due to the small amount of information in the model, relative to the information set potentially observed by agents, it easily suffers from the omitted variable problem that can alter the impulse response analysis. The second problem in small-scale VAR model is that the choice of a specific data series to represent a general economic concept is arbitrary. Moreover, measurement errors, aggregations, and revisions present additional problems when linking theoretical concepts to specific data series. Finally, even if the previous problems do not occur, we can produce impulse responses only for the variables included in the VAR.

One way to address all these issues is to take advantage of information contained in large panel data sets using dynamic factor analysis, and in particular the factor-augmented VAR (FAVAR) model. The importance of large data sets and factor analysis is well documented in both forecasting macroeconomic aggregates and structural analysis. Recently, Boivin, Giannoni and Stevanovic (2009) showed that incorporating information through a small number of factors corrects for several empirical puzzles, when estimating the effect of monetary policy shocks in a small open economy. For these reasons, we re-examine the VAR evidence of credit shocks' effects on economic activity using FAVAR model.

4.1 Factor-augmented VAR model

Here, we briefly present the static factor model. It is worth noting that assuming the static factor model is not very restrictive since the dynamic factor model can be written in static form, where some arbitrary static factors represent lagged dynamic factors (see Stock and Watson (2005)). The model is

$$X_t = \Lambda F_t + u_t \quad (1)$$
$$F_t = \Phi(L) F_{t-1} + e_t \quad (2)$$

where X_t contains N economic and financial indicators, F_t represents K unobserved factors, Λ is $N \times K$ matrix of factor loadings, u_t are idiosyncratic components of X_t uncorrelated with e_t and F_t. If we allow for some limited cross-section correlations among the idiosyncratic components in (1) (such that there exists a small number of largest eigenvalues of the covariance matrix of common components that diverge when the number of series tends to infinity, while the remaining eigenvalues as well as the eigenvalues of the covariance matrix of specific components are bounded), we obtain the approximate factor model [1].

4.2 Estimation

The unknown coefficients in (1)-(2) could be estimated by Gaussian maximum likelihood using the Kalman filter (or by Quasi ML), see Engle and Watson (1981), Stock and Watson (1989), Sargent (1989). This method is computationally burdensome when N is very large, but also the misspecification becomes very likely. However, there are some recent improvements: Kalman filter speedup by Jungbacker and Koopman (2008), using principal components as very good starting values then a single pass of the Kalman filter by Giannone, Reichlin, and Sala (2004), and principal components for starting values then use EM algorithm to convergence by Doz, Giannone, and Reichlin (2006).

An alternative to the simultaneous equations likelihood-based estimation is the two-step principal components procedure, where factors are approximated in the first step, and then the dynamic process of factors is estimated in the second step. The main result is that factors can be approximated by Principal Components Analysis (PCA) estimator. Stock and Watson (2002a) prove consistency of these estimators in approximate factor model when both cross-section and time sizes, N, T, go to infinity, and without restrictions on N/T. Moreover, they justify using $\hat{F}_t$ as regressor without adjustment. Bai and Ng (2006) improve these results by showing that PCA estimators are $\sqrt{T}$ consistent and asymptotically normal if $\sqrt{T}/N \to 0$. Except when T/N goes to zero, inference should take into account the effect of generated regressors.

The principal components approach is easy to implement and do not require very strong distributional assumptions. Recently, the simulation exercises showed that likelihood-based and two-step procedures perform quite similarly in approximating the space spanned by latent factors. Moreover, in Bernanke, Boivin and Eliasz (2005) the authors estimated their model using both two-step principal components and single-step Bayesian likelihood methods, but they obtained essentially

[1] See Bai and Ng (2008) for an overview of the modern factor analysis literature, and the distinction between exact and approximate factor models.

the same results. For these reasons, we consider the PCA approach. However, since the unobserved factors are estimated and then included as regressors in FAVAR model, and given that the number of series in our application is small, relative to the number of time periods, the two-step approach suffers from the "generated regressors"problem. To get the accurate statistical inference on the impulse response functions, that accounts for uncertainty associated to factors estimation, we use the bootstrap procedure proposed by Kilian (1998).

4.3 Identification of structural shocks

To identify the structural shocks, we employ the contemporaneous timing restrictions procedure proposed in Stock and Watson (2005). After inverting the VAR process of factors in (2), assuming stationarity, and plugging it in (1), we obtain the MA representation of X_t:

$$\begin{aligned} X_t &= \Lambda[I - \Phi(L)L]^{-1} e_t + u_t \\ &= B(L)e_t + u_t. \end{aligned} \tag{3}$$

We assume that the number of static factors, K, is equal to the number of dynamic factors and that residuals in (2) are linear combinations of structural shocks ε_t

$$\varepsilon_t = He_t, \tag{4}$$

where H is a nonsingular square matrix and $\mathrm{E}[\varepsilon_t \varepsilon_t'] = I$. Replacing (4) in (3) gives the structural MA form of X_t:

$$\begin{aligned} X_t &= \Lambda[I - \Phi(L)L]^{-1} H^{-1} \varepsilon_t + u_t \\ &= B^\star(L)\varepsilon_t + u_t. \end{aligned} \tag{5}$$

To achieve the identification of shocks in ε_t, the contemporaneous timing restrictions are imposed on the impact matrix in (5)

$$B_0^\star \equiv B^\star(0) = \begin{bmatrix} x & 0 & \cdots & 0 \\ x & x & \ddots & 0 \\ x & x & \ddots & 0 \\ x & x & \cdots & x \\ \vdots & \vdots & \vdots & \vdots \\ x & x & \cdots & x \end{bmatrix}.$$

Let $B_{0:K}^\star = B_{0:K}H^{-1}$ be a $K \times K$ lower triangular matrix, where $B_{0:K}$ contains first K rows of B_0. Then, H is obtained as

$$H = [\mathrm{Chol}(B_{0:K}\Sigma_e B_{0:K}')]^{-1}\Lambda_K, \tag{6}$$

where Σ_e is covariance matrix of e_t and Λ_K is $K \times K$ matrix of first K rows of Λ. To estimate H, we just plug the estimates of $B_{0:K}$, Σ_e and Λ_K. Hence, the impulse responses to any shock in ε_t are obtained using (5). This identification procedure is similar to the standard recursive identification in VAR models. To just-identify the K structural shocks, we need to impose $K(K -$

1)/2 restrictions. Imposing them in recursive way makes estimation of the rotation matrix H easy. Also, it should be noted that the number of static factors must be equal to the number of series used in recursive identification. Moreover, contrary to other identification strategies in FAVAR literature, we do not need to impose any observed factor nor to rely on the interpretation of a particular latent factor[2].

In our application, we use three different specifications. First, we consider a monthly balanced panel and impose the following recursive structure: [CPI, UR, FFR, B-spread]. This means that consumer price index (CPI), unemployment rate (UR) and Federal Funds rate (FFR) do not respond immediately to a surprise increase of the B-spread (we use 10-year B-spread), that is interpreted as the credit shock. Hence, this identification scheme is close to identification strategy in Gilchrist, Yankov and Zakrajsek (2009) in sense that the shock is seen as an unexpected increase of the external finance premium. However, it is important to remark that the shock in our approach is not directly on B-spread but on the last element of vector ε_t. The impulse response of B-spread is determined by its factor loading and the corresponding element in the rotation matrix H. Another difference is that we do not impose all economic activity measures to respond only with lag to the credit shock.

The second specification considers a mixed-frequencies monthly panel constructed as in Boivin, Giannoni and Stevanovic (2009). The goal is to use the informational content from quarterly indicators to better approximate the space spanned by structural shocks, and to achieve a more reliable identification of these shocks. The recursive structure is [PCE, UR, C, I, FFR], while the credit shock and the monetary policy shock are ordered fourth and fifth in ε_t. This particular identification scheme implies that Personal Consumption Expenditure Price Index (PCE), UR and Consumption (C) do not respond immediately to both credit and monetary policy shocks. To identify the credit shock we impose that Investment (I) can respond immediately to the credit shock, while it does not react to the monetary policy contemporaneously. Finally, we let the Federal Funds Rate (FFR) respond immediately to the credit shock. Remark that a measure of the external finance premium is not required to enter in this recursive structure. The impact responses of credit spreads are determined only by their factor loadings and the rotation matrix H.

Finally, we consider a balanced quarterly panel and identify the credit shock using the sign restrictions strategy. To obtain the initial orthogonalized innovations we start from the recursive structure on [PCE, GDP, C, I, FFR]

$$X_t \simeq B^\star(L)\varepsilon_t.$$

Then, we generate an orthogonal matrix Q, using QR decomposition, such that

$$X_t \simeq \tilde{B^\star}(L)\tilde{\varepsilon}_t,$$

where $\tilde{B^\star}(L) = B^\star(L)Q$ and $\tilde{\varepsilon}_t = Q'\varepsilon_t$. The sign restrictions are imposed on the impact matrix $\tilde{B^\star}(0)$:

[2] In Bernanke, Boivin and Eliasz (2005) and Boivin, Giannoni and Stevanovic (2009), the authors impose a short-term interest rate as an observed factor, and the monetary policy shock is identified on the factors VAR interest rate equation. In Gilchrist, Yankov and Zakrajsek (2009), the authors divide factors in those explaining a panel of economic activity indicators and in those related to credit spreads, interpreted as "financial factors". The credit shock is identified as a shock on the structural error of the first "financial factor".

$$\frac{\partial(PCE_t)}{\partial(\varepsilon_t^{CS})} \leq 0, \quad \frac{\partial(GDP_t)}{\partial(\varepsilon_t^{CS})} \leq 0, \quad \frac{\partial(C_t)}{\partial(\varepsilon_t^{CS})} \leq 0, \quad \frac{\partial(I_t)}{\partial(\varepsilon_t^{CS})} < \frac{\partial(C_t)}{\partial(\varepsilon_t^{CS})}.$$

Hence, we impose that the impact response of PCE inflation, GDP, consumption and investments growths to a positive credit shock is non positive. The last restrictions is that investment (nonresidential) respond quantitatively more than consumption.

4.4 Data

In order to investigate the effects of the credit shock in data-rich environment, we apply the structural factor approach using large data panels containing U.S. economic and financial indicators, observed at monthly and quarterly frequencies. The first data set is a balanced monthly panel, updated version of data set in Bernanke, Boivin and Eliasz (2005), containing 124 monthly U.S. economic and financial series. We also consider 58 quarterly U.S. macroeconomic series. The last data set is an updated version from Boivin and Giannoni (2006), that contains 220 quarterly U.S. series. All series are initially transformed to induce stationarity. The description of series and their transformation is presented in the Appendix. As mentioned above, we consider three specifications: monthly balanced panel, mixed-frequencies monthly panel, and balanced quarterly panel. The mixed-frequencies panel is obtained using EM algorithm as in Stock and Watson (2002b), and Boivin, Giannoni and Stevanovic (2009). The time span for all panels is from 1959-01-01 to 2008-12-01. Hence, in the first specification there are 124 indicators in informational panel X_t observed over 600 periods. In the second approach we work with 182 series observed over the same periods, and in the case of the balanced quarterly panel there are 220 series observed over 200 periods.

5 Results

In this section, we present the main empirical results from our three specifications. In principle, we can plot the impulse responses of all variables contained in the informational panel X_t, but we will focus on a subset of economic and financial indicators of interest. In all cases, the impulse on the component of ε_t corresponding to the credit shock is of size 1. The lag order in VAR dynamics in (2) is set to 3. Finally, the 90% confidence intervals are computed using 5000 bootstrap replications.

5.1 Monthly balanced panel

We first present results from the first specification where the monthly balanced panel is used. Remember that the recursive identification scheme is [CPI, UR, FFR, B-spread], implying that we extract four static factors from X_t. The impulse responses to the credit shock are plotted in Figure 6. The impact response of B-spread is almost 0.2 basic points relative to its steady state value. This unexpected increase in the external finance premium generates a significant and very persistent economic downturn through the transmission channels discussed above. For example, economic activity indicators such as production, employment, hours, prices and wages decline significatively. In particular, industrial production and consumption go down significatively for a long period. The price indicators, such CPI, core CPI, and PPI, show a very persistent decline. The labor market indicators, unemployment rate and average unemployment duration, rise significatively for more than 3 years, while employment and wages decline. The leading indicators, such consumer expectations, new orders, housing starts, and commodity price index, react negatively, as expected from theory, at the impact. Finally, the interest rates decline, and the monetary aggregates increase progressively.

The impulse responses in Figure 6 are similar to results reported in Gilchrist, Yankov and Zakrajsek (2009), except that in our approach the economic and financial indicators, that should respond immediately to an unexpected increase in the external finance premium, do react on impact.

The Table 4 contains variance decomposition results. The first column reports the contribution of the credit shock to the variance of the forecast error at 48-month horizon, and the second column contains the R^2 of the common component. Surprisingly, and contrary to VAR results, the credit shock has an important effect, more than 50 percents, on several variables: industrial production, consumer credit, capacity utilization rate, labor market series, some leading indicators and credit spreads. Looking at the R^2 results, we see that the common component explains a sizeable fraction of the variability in these variables, especially for industrial production, prices, financial indicators, average unemployment duration, capacity utilization and consumer expectations. This means that factors do capture important dimensions of the business cycle movements.

5.1.1 Interpretation of factors

Another interesting feature of our identification approach is to obtain the rotation matrix H that can be used to interpret estimated factors. Remember the assumption from Section 4.3, that structural shocks are linear combination of residuals, $\varepsilon_t = He_t$. Using this hypothesis, we can rewrite the system (1)-(2) in its structural form

$$X_t = \Lambda^\star F_t^\star + u_t \tag{7}$$

$$F_t^\star = \Phi^\star(L) F_{t-1}^\star + \varepsilon_t \tag{8}$$

where $F_t^\star = HF_t$, $\Lambda^\star = \Lambda H^{-1}$, and $\Phi^\star(L) = H\Phi(L)H^{-1}$. Hence, given the estimates of F_t and H, we can obtain the estimate of structural factors: $\hat{F}_t^\star = \hat{H}\hat{F}_t$. In Table 5, we present correlation coefficients between estimated F_t, $F_t^\star$, and the variables used in the recursive identification scheme, and we plot them in Figure 7. In Table 6, we present the marginal contribution of each factor to the total R^2. From columns associated to the elements of F_t in Tables 5 and 6, we see that any interpretation in terms of the economic indicators is arbitrary, which is not surprising since the factors are identified up to a rotation, picked by the PCA estimator. The picture changes when we look at columns associated to the elements of the rotated estimated factors. The results in last four columns of Table 5 show that $F_{1,t}^\star$ is highly correlated to CPI, $F_{2,t}^\star$ to unemployment rate, $F_{3,t}^\star$ to FFR and $F_{4,t}^\star$ to credit spread. Figure 7 illustrates that the rotation by $\hat{H}$ makes the estimated factors very close to observed indicators used in the recursive identification scheme. However, to have a more reliable idea about the informational content of each rotated factor, we compare its marginal contributions to the total R^2. According to results in Table 6, the first rotated factor accounts for almost all variations in prices, that is explained by the common component. The second factor is important for unemployment rate, M1, capacity utilization rate, consumer expectations, and credit spread. The third rotated factor explains well financial indicators and exchange rate, while the fourth factor is related to real activity measures, housing starts, and new orders.

5.2 Mixed-frequencies panel

Now, we present results from the second specification, where we use the mixed-frequencies monthly panel. The recursive identification is based on the following ordering [PCE, UR, C, I, FFR], which implies extraction of five factors. The impulse responses are presented in Figure 9. The impact response of B-spread is a little bit more than 0.2. As in the previous specification, this unexpected increase of the external finance premium generates a significative and persistent economic slowdown. The price indexes decline largely and significatively. Industrial production and consumption present a significant downturn for about 18 months after the shock. On the labor market, there are significant positive reactions of unemployment rate and average unemployment duration (and the response of the latter is more persistent), while employment and salaries indicators decline. The leading indicators of economic activity, housing starts, new orders, and consumer expectations, react negatively and significatively on impact. Note that in this identification strategy, the impact responses of interest rates are not restricted any more. Indeed, they respond negatively and significatively on impact. In Figure 10, we present impulse responses of some monthly indicators constructed from the quarterly observed variables. These are GDP components and two price indexes. We can see that GDP and PCE deflators decline in persistent and significative way, while the responses of other variables are quite imprecise. However, we remark that after a positive impact response, most of them decline progressively.

The Table 7 contains variance decomposition and R^2 results, as in Table 4. The conclusion is slightly different when compared to the previous specification. According to results in the first column of Table 7, the credit shock has a sizeable effect on prices, financial indicators including FFR, capacity utilization rate and consumer credit, but a smaller effect on real economic activity measures than it was the case with the monthly balanced panel. The results from the second column suggest that the common component explains approximatively the same amount of variability in data as in the previous specification. Hence, adding information from quarterly series using mixed-frequencies data, changing the identification strategy and adding one more factor, does not affect a lot the R^2 results, but does affect the variance decomposition results. Moreover, having impulse responses on GDP components, observed only quarterly, completes the picture of the effect of credit shocks.

5.2.1 Interpretation of factors

As in the previous specification, we can check how the rotation matrix change the correlation structure between the estimated factors and the economic indicators used in the recursive identification scheme. The Tables 8 and 9 contain correlation coefficients and marginal R^2, and Figure 11 plot principal components, rotated factors, and the corresponding series. Again, there is no obvious interpretation on correlation structure between principal components and five variables. When we rotate them by matrix $\hat{H}$, we can easily link the first factor to PCE index, the second to unemployment rate and the fifth to short rate. However, the interpretation of third and fourth factors is arbitrary. According to marginal R^2 results in Table 9, the first factor is important for price series, the second for unemployment rate, money base measures, credit spread and capacity utilization. The third factor is related to consumption series, GDP and investment, while the fourth element of F_t^* contributes mainly in explaining variations in commodity price index and salaries. Finally, the fifth factor is important for industrial production, employment and new orders.

5.3 Quarterly balanced panel

In the final specification, we use a quarterly balanced panel and the sign restrictions framework to identify the credit shock. The results are obtained by simulating 10000 orthogonal matrices. Among them, 924 have been retained, i.e. they respected the sign restrictions. The impulse responses using the median orthogonal matrix are presented in Figure 11, and all retained impulse responses are plotted in Figure 12. According to results in Figure 11, the dynamic effects of the credit shock are similar to what we have observed in previous specifications. There is a sizeable economic downturn: production, employment, consumer credit, and prices decline, while unemployment rate and average unemployment duration rise. The interest rates, housing starts, new orders, and capacity utilization rate react negatively on impact, while credit spreads respond positively as expected. However, compared to previous monthly applications, the effects of credit shock seem to be less persistent. The results in Figure 12 show a huge dispersion in impulse responses satisfying sign restrictions. Therefore, the confidence intervals containing all these responses will also contain zero for most of variables and horizons.

In Table 10 we present variance decomposition and R^2 results. Contrary to two monthly applications, here the credit shock has a smaller effect on most of the variables. It explains between 20 and 30 percent of forecast error in NAPM production index, FFR, and some leading indicators, but has a small effect on prices and monetary measures. The R^2 results suggest that the extracted factors explain an important fraction of the variability in these series.

5.3.1 Interpretation of factors

Tables 11 and 12 contain the correlation coefficients and the marginal contributions to the total R^2. Figure 13 plots principal components, rotated factors, and corresponding series. Again, there is no obvious interpretation on correlation structure between principal components and five variables. When we rotate them by matrix $\hat{H}$, the first factor becomes linked to PCE index, the second to GDP and the fifth to short rate. However, the interpretation of the third and fourth factors is arbitrary. According to results in Table 12, the first factor is important for price series, FFR and treasury bills, and the second explains mostly the real activity measures such as GDP, industrial production, employment, salaries and consumption, and housing starts, new orders and consumer credit. The third and fourth factors seem to be related to monetary measures and exchange rate. Finally, the fifth factor is important for unemployment rate (together with the third factor), capacity utilization rate and average unemployment duration.

6 Conclusion

In this paper, we re-examined the evidence on the propagation mechanism of credit shocks to economic activity. The analysis was done in data-rich environment using a structural factor model. The structural shocks were identified by imposing a recursive structure on the impact matrix of the structural MA representation of observable variables.

The results showed that an unexpected increase in the external finance premium generates a significant and persistent economic slowdown. Since we did not impose timing restrictions on forward-looking variables, these leading indicators respond, as expected, negatively on impact. This gives a more realistic picture of the effect of credit shocks on economy, and informs about the transmission mechanism of these shocks. According to R^2 results, the common component explains an important fraction of variability in observable variables. Hence, the factors capture a sizeable dimension of the business cycle movements.

From the variance decomposition analysis, we observed that the credit shock has an important effect on several real activity measures, price indicators, leading indicators, and credit spreads. Moreover, a by-product of our identification approach is a rotation matrix that can be used to recover structural factors. They still have the same informational content but their interpretation, in terms of the correlation structure, can change. Indeed, we find that the rotated principal components do have an economic interpretation. Finally, we found these results robust to different data frequencies and identification schemes.

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Table 1: Proxies for the external finance premium

Series description		Time span
FYAAAC	BOND YIELD: MOODY'S AAA CORPORATE	1959M01-2008M12
FYBAAC	BOND YIELD: MOODY'S BAA CORPORATE	1959M01-2008M12
FYGT1	INTEREST RATE: U.S.TREASURY CONST MATURITIES,1-YR.	1959M01-2008M12
FYGT10	INTEREST RATE: U.S.TREASURY CONST MATURITIES,10-YR.	1959M01-2008M12
FYFF	INTEREST RATE: FEDERAL FUNDS (EFFECTIVE)	1959M01-2008M12
USLibor3m	US Libor rate 3 month (from bba.org.uk)	1986M01-2008M10
Credit spreads		
10Y B-spread	FYBAAC-FYGT10	1959M01-2008M12
10Y A-spread	FYBAAA-FYGT10	1959M01-2008M12
1Y B-spread	FYBAAC-FYGT1	1959M01-2008M12
3M Ted spread	USLibor3m-FFR	1986M01-2008M10

Table 2: VAR models used to study effects and identification of financial shock

Models	Wald causaility ordering
Benchmark	$[\pi_t, UR_t, R_t, 10yBS_t]$
Model 1	$[\pi_t, IP_t, UR_t, R_t, 10yBS_t]$
Model 2	$[\pi_t, UR_t, 10yBS_t, R_t]$
Model 3	$[\pi_t, UR_t, R_t, 10yBS_t, 3mTS_t]$
Model 4	$[\pi_t, UR_t, R_t, 3mTS_t, 10yBS_t]$
Model 5	$[\pi_t, UR_t, R_t, 1yBS_t]$
Model 6	$[\pi_t, UR_t, R_t, 10yAS_t]$
Model 7	$[\pi_t, UR_t, R_t, 3mTS_t]$

Table 3: Variance decomposition: contribution of the credit shock

Variables	Benchmark	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
CPI	0.0303	0.0278	0.0368	0.0301	0.0324	0.0052	0.0333	0.0054
Unemployment rate	0.1642	0.1468	0.1746	0.1637	0.1642	0.1545	0.0929	0.0031
FFR	0.4020	0.3797	0.5343	0.4031	0.3947	0.2296	0.3800	0.0040
B-spread: 10y	0.9432	0.9171	0.9512	0.9412	0.9273			
Industrial production		0.0439						
Ted spread: 3m				0.0163	0.0032			0.9737
B-spread: 1y						0.6874		
A-spread: 10y							0.9584	

Table 5: Correlation between estimated and rotated factors, and variables in recursive identification with monthly balanced panel

	Correlation[indexF, F_t]				Correlation[indexF, F_t^*]			
	$F_{1,t}$	$F_{2,t}$	$F_{3,t}$	$F_{4,t}$	$F_{1,t}^*$	$F_{2,t}^*$	$F_{3,t}^*$	$F_{4,t}^*$
CPI	0.3267	-0.6760	-0.1618	-0.4547	0.8925	0.2935	0.4822	0.1220
UR	0.5263	0.0171	0.6392	0.1518	-0.0135	0.7906	-0.1070	0.7752
FFR	0.5716	-0.7482	0.0659	0.0700	0.7282	0.6328	0.7091	0.4062
Bspread	0.5499	0.4749	0.3355	-0.1302	-0.1529	0.4996	-0.4542	0.7073

Table 4: Variance decomposition and R^2 in recursive identification with monthly balanced panel

Variables	Variance decomposition	R^2
Industrial production	0.5289	0.7140
CPI: total	0.0591	0.7966
CPI: core	0.1223	0.6123
T-Bill: 3-month	0.1509	0.8839
T-Bond: 5-year	0.1144	0.9132
Unemployment rate	0.2615	0.7089
M1	0.1418	0.0919
M2	0.0308	0.1149
Consumer credit	0.6492	0.1778
Exchange rate: average	0.0326	0.0530
Commodity price index	0.3135	0.5214
PPI: finished goods	0.0424	0.5949
Capacity utilization rate	0.7469	0.7476
Real Pers. Cons.	0.2360	0.1401
Real Pers. Cons.: services	0.2343	0.1283
Avg. unemployment duration	0.4248	0.7597
Employment	0.5946	0.2879
Avg weekly hours	0.4948	0.3819
Avg hourly earnings	0.3949	0.2164
Housing starts	0.6002	0.4676
New orders	0.4452	0.2473
S&P's CCS: dividend yield	0.1605	0.7529
Consumer expectations	0.3188	0.5338
FFR	0.1347	0.8957
B-spread: 10y	0.7727	0.6574

Table 6: Marginal contribution to R^2 with monthly balanced panel

	F_1	F_2	F_3	F_4	F_1^*	F_2^*	F_3^*	F_4^*
Industrial production	0.5537	0.1393	0.3043	0.0027	0.0136	0.0021	0.0000	0.9843
CPI: total	0.1340	0.5736	0.0329	0.2596	1.0000	0.0000	0.0000	0.0000
CPI: core	0.3179	0.6793	0.0009	0.0019	0.7368	0.1014	0.1616	0.0002
T-Bill: 3-month	0.3261	0.6428	0.0199	0.0113	0.5425	0.2291	0.2237	0.0047
T-Bond: 5-year	0.3626	0.4730	0.1467	0.0177	0.3648	0.4720	0.1459	0.0174
Unemployment rate	0.3907	0.0004	0.5764	0.0325	0.0003	0.9997	0.0000	0.0000
M1	0.2693	0.0420	0.3895	0.2993	0.1275	0.8016	0.0629	0.0080
M2	0.0795	0.0307	0.0756	0.8142	0.0748	0.2914	0.6311	0.0027
Consumer credit	0.6387	0.3348	0.0265	0.0000	0.0136	0.1490	0.0205	0.8169
Exchange rate: average	0.0642	0.0611	0.0711	0.8036	0.0506	0.2640	0.6754	0.0100
Commodity price index	0.0764	0.6462	0.1310	0.1464	0.5902	0.2710	0.0131	0.1257
PPI: finished goods	0.0389	0.3666	0.0654	0.5291	0.8982	0.0396	0.0622	0.0000
Capacity utilization rate	0.3695	0.3580	0.2661	0.0064	0.0803	0.5850	0.1764	0.1583
Real Pers. Cons.	0.4418	0.0015	0.2662	0.2905	0.3390	0.0040	0.0729	0.5841
Real Pers. Cons.: services	0.4361	0.0482	0.0405	0.4752	0.2144	0.0218	0.3180	0.4457
Avg. unemployment duration	0.0001	0.3352	0.5322	0.1326	0.1462	0.2488	0.5861	0.0189
Employment	0.4915	0.3344	0.1669	0.0072	0.0227	0.0233	0.0002	0.9538
Avg weekly hours	0.7537	0.0007	0.0002	0.2454	0.0022	0.3885	0.2424	0.3669
Avg hourly earnings	0.0412	0.8748	0.0153	0.0688	0.4509	0.0052	0.4909	0.0529
Housing starts	0.6263	0.2254	0.0565	0.0918	0.0328	0.1410	0.0319	0.7943
New orders	0.4368	0.0528	0.4952	0.0153	0.0667	0.0181	0.0018	0.9133
S&P's CCS: dividend yield	0.3327	0.4663	0.0134	0.1875	0.2368	0.2710	0.4921	0.0000
Consumer expectations	0.8944	0.0287	0.0011	0.0758	0.3703	0.3290	0.0053	0.2955
FFR	0.3647	0.6250	0.0048	0.0055	0.5921	0.1936	0.2143	0.0000
B-spread: 10y	0.4600	0.3430	0.1712	0.0258	0.0355	0.5156	0.2008	0.2481

Table 7: Variance decomposition and R^2 in recursive identification with mixed-frequencies monthly panel

Variables	Variance decomposition	R^2
Industrial production	0.2929	0.7313
CPI: total	0.5139	0.6263
CPI: core	0.5656	0.6211
T-Bill: 3-month	0.6723	0.8640
T-Bond: 5-year	0.6611	0.8948
Unemployment rate	0.1915	0.6946
M1	0.1601	0.1090
M2	0.1899	0.0323
Consumer credit	0.4470	0.1893
Exchange rate: average	0.0941	0.0270
Commodity price index	0.7903	0.4731
PPI: finished goods	0.5114	0.3077
Capacity utilization rate	0.7220	0.7405
Real Pers. Cons.	0.0559	0.3819
Real Pers. Cons.: services	0.1930	0.1086
Avg. unemployment duration	0.3727	0.6242
Employment	0.3980	0.3037
Avg weekly hours	0.2261	0.3015
Avg hourly earnings	0.4290	0.3364
Housing starts	0.4582	0.4329
New orders	0.2519	0.2500
S&P's CCS: dividend yield	0.5861	0.6147
Consumer expectations	0.1652	0.5088
FFR	0.6016	0.8802
B-spread: 10y	0.7096	0.6416
Real GDP	0.0737	0.9338
Real GDP: goods	0.0890	0.8860
Real GDP: services	0.0518	0.8769
Employees compensation	0.0641	0.8812
Gov. consumption	0.1032	0.6009
Investment	0.0926	0.8599
Invst.: nonresidential	0.0714	0.9012
GDP deflator	0.1940	0.6547
PCE deflator	0.1302	0.7935

Table 8: Correlation between estimated and rotated factors, and variables in recursive identification with monthly mixed-frequencies data

	Correlation[indexF, F_t]					Correlation[indexF, F_t^*]				
	$F_{1,t}$	$F_{2,t}$	$F_{3,t}$	$F_{4,t}$	$F_{5,t}$	$F_{1,t}^*$	$F_{2,t}^*$	$F_{3,t}^*$	$F_{4,t}^*$	$F_{5,t}^*$
PCE	0.1779	0.6894	0.0721	-0.5272	0.0581	0.8908	0.1351	-0.1274	-0.2687	0.3597
UR	-0.2369	0.3634	-0.3249	0.1541	-0.6141	0.0764	0.8319	-0.7171	0.4242	0.7006
C	0.5141	-0.0801	-0.1664	0.2536	-0.1385	-0.1319	0.0245	0.2848	0.0138	-0.0909
I	0.8099	0.2131	-0.3898	-0.0815	-0.0043	0.3431	0.0235	0.3874	0.0303	-0.0247
FFR	-0.1066	0.8734	0.2714	0.1528	-0.0947	0.5801	0.4356	-0.4304	-0.3412	0.7672

Table 9: Marginal contribution to R^2 with monthly mixed-frequencies data

	F_1	F_2	F_3	F_4	F_5	F_1^*	F_2^*	F_3^*	F_4^*	F_5^*
Industrial production	0.3722	0.0372	0.1777	0.0975	0.3153	0.0240	0.0065	0.2188	0.1865	0.5643
CPI: total	0.0019	0.8011	0.1551	0.0012	0.0407	0.5887	0.0000	0.0070	0.1881	0.2162
CPI: core	0.0137	0.8546	0.1270	0.0047	0.0000	0.4625	0.0628	0.0262	0.2417	0.2069
T-Bill: 3-month	0.0071	0.8433	0.0911	0.0280	0.0304	0.3695	0.1699	0.0041	0.2804	0.1760
T-Bond: 5-year	0.0136	0.7499	0.0329	0.0360	0.1676	0.2731	0.3988	0.0006	0.2403	0.0873
Unemployment rate	0.0808	0.1901	0.1519	0.0342	0.5429	0.0084	0.9916	0.0000	0.0000	0.0000
M1	0.4904	0.0005	0.0042	0.0638	0.4412	0.1032	0.6443	0.2062	0.0343	0.0119
M2	0.1950	0.1857	0.0166	0.1620	0.4407	0.0007	0.6933	0.0465	0.2443	0.0152
Consumer credit	0.6791	0.0094	0.2864	0.0001	0.0251	0.0165	0.1472	0.4326	0.2972	0.1066
Exchange rate: average	0.1637	0.5082	0.1929	0.0611	0.0741	0.5264	0.2092	0.2073	0.0552	0.0019
Commodity price index	0.1450	0.1382	0.5949	0.0053	0.1166	0.2416	0.3128	0.0106	0.4062	0.0289
PPI: finished goods	0.0461	0.6329	0.1662	0.0145	0.1404	0.4157	0.0349	0.0071	0.1940	0.3482
Capacity utilization rate	0.2122	0.0021	0.5721	0.0077	0.2059	0.0396	0.6694	0.0237	0.2672	0.0002
Real Pers. Cons.	0.6921	0.0168	0.0725	0.1684	0.0502	0.0456	0.0053	0.9491	0.0000	0.0000
Real Pers. Cons.: services	0.6349	0.0930	0.0724	0.1551	0.0446	0.0912	0.0437	0.6569	0.1824	0.0257
Avg. unemployment duration	0.0096	0.1435	0.3114	0.0006	0.5350	0.1527	0.4265	0.0208	0.1243	0.2756
Employment	0.2846	0.0028	0.3902	0.1257	0.1967	0.0881	0.0342	0.1034	0.3363	0.4380
Avg weekly hours	0.4182	0.3666	0.1319	0.0833	0.0000	0.0195	0.3945	0.1837	0.0237	0.3786
Avg hourly earnings	0.0824	0.1672	0.6705	0.0768	0.0030	0.0249	0.0003	0.1320	0.7736	0.0691
Housing starts	0.4286	0.0492	0.4255	0.0095	0.0872	0.0025	0.1180	0.2226	0.3908	0.2660
New orders	0.1761	0.0866	0.1372	0.0409	0.5592	0.0019	0.0159	0.1318	0.2023	0.6481
S&P's CCS: dividend yield	0.0224	0.8496	0.0616	0.0398	0.0266	0.3305	0.2061	0.0111	0.2369	0.2154
Consumer expectations	0.2517	0.6571	0.0866	0.0046	0.0000	0.2148	0.3383	0.1360	0.0149	0.2960
FFR	0.0129	0.8667	0.0837	0.0265	0.0102	0.3823	0.1405	0.0103	0.2457	0.2212
B-spread: 10y	0.2776	0.0103	0.5795	0.0045	0.1281	0.0229	0.6147	0.0549	0.3035	0.0041
Real GDP	0.7243	0.0239	0.1817	0.0681	0.0021	0.0107	0.0000	0.8954	0.0467	0.0472
Real GDP: goods	0.7311	0.0512	0.2146	0.0009	0.0023	0.0865	0.0004	0.8019	0.0988	0.0123
Real GDP: services	0.0688	0.0943	0.1299	0.7069	0.0000	0.5760	0.0009	0.0092	0.2823	0.1316
Employees compensation	0.7016	0.0010	0.0412	0.2528	0.0035	0.0141	0.0073	0.8944	0.0012	0.0830
Gov. consumption	0.4116	0.0900	0.2948	0.1792	0.0244	0.3330	0.0075	0.3325	0.3254	0.0015
Investment	0.7627	0.0528	0.1767	0.0077	0.0000	0.1369	0.0010	0.7723	0.0899	0.0000
Invst.: nonresidential	0.7003	0.0234	0.0801	0.1824	0.0137	0.0003	0.0049	0.8734	0.0032	0.1182
GDP deflator	0.0141	0.6406	0.1146	0.2304	0.0002	0.8248	0.0046	0.0982	0.0688	0.0036
PCE deflator	0.0399	0.5990	0.0065	0.3503	0.0043	1.0000	0.0000	0.0000	0.0000	0.0000

Table 10: Variance decomposition and R^2 in recursive identification with quarterly balanced panel

Variables	Variance decomposition	R^2
NAPM Production index	0.2175	0.7841
Industrial production	0.1611	0.5992
CPI: total	0.0136	0.9387
CPI: core	0.0149	0.8644
T-Bill: 3-month	0.2098	0.8817
T-Bond: 5-year	0.1504	0.8786
Unemployment rate	0.1093	0.6689
M1	0.0699	0.3082
M2	0.0746	0.2859
Consumer credit	0.1182	0.3148
Exchange rate: average	0.1609	0.2084
Commodity price index	0.0395	0.6728
PPI: finished goods	0.0163	0.8151
Capacity utilization rate	0.1402	0.8069
Real Pers. Cons.	0.1514	0.6304
Real Pers. Cons.: services	0.0841	0.5347
Avg. unemployment duration	0.1239	0.5748
Employment	0.1288	0.6847
Avg weekly hours	0.3115	0.4829
Avg hourly earnings	0.0682	0.2523
Housing starts	0.2278	0.5628
New orders	0.2526	0.7960
S&P's CCS: dividend yield	0.3802	0.1922
Consumer expectations	0.0752	0.6804
FFR	0.2270	0.9006
B-spread: 10y	0.1045	0.6476
Real GDP	0.1895	0.6872
Real GDP: goods	0.1782	0.4800
Real GDP: services	0.0514	0.2914
Employees compensation	0.1295	0.7626
Gov. consumption	0.1692	0.0108
Investment	0.0908	0.4821
Invst.: nonresidential	0.0968	0.3160
GDP deflator	0.0152	0.8620
PCE deflator	0.0072	0.9589

Table 11: Correlation between estimated and rotated factors, and variables in recursive identification with quarterly balanced panel

	Correlation[indexF, F_t]					Correlation[indexF, F_t^*]				
	$F_{1,t}$	$F_{2,t}$	$F_{3,t}$	$F_{4,t}$	$F_{5,t}$	$F_{1,t}^*$	$F_{2,t}^*$	$F_{3,t}^*$	$F_{4,t}^*$	$F_{5,t}^*$
PCE	0.7984	-0.5061	-0.0176	-0.2051	-0.1514	0.9792	-0.1773	0.5913	0.7062	0.4970
GDP	-0.5479	-0.5867	0.2054	-0.0122	0.0195	-0.1477	0.8290	-0.1886	-0.1546	-0.1882
C	-0.5548	-0.3829	0.3726	0.1923	-0.0150	-0.2992	0.7274	-0.0521	-0.2495	-0.1399
I	-0.1823	-0.4442	-0.1237	-0.1027	0.2442	0.0670	0.4110	-0.2252	0.1753	-0.0973
FFR	0.7227	-0.3848	0.1207	0.0356	0.4630	0.7070	-0.1671	0.5193	0.9145	0.6658

Table 12: Marginal contribution R^2 with quarterly balanced panel

	F_1	F_2	F_3	F_4	F_5	F_1^*	F_2^*	F_3^*	F_4^*	F_5^*
NAPM Production index	0.4434	0.5155	0.0007	0.0089	0.0315	0.0154	0.8683	0.0431	0.0286	0.0446
Industrial production	0.3554	0.6345	0.0079	0.0019	0.0004	0.0078	0.9595	0.0055	0.0048	0.0223
CPI: total	0.6411	0.2659	0.0150	0.0709	0.0071	0.9807	0.0003	0.0168	0.0022	0.0000
CPI: core	0.6168	0.2323	0.0352	0.0574	0.0584	0.7625	0.0002	0.1965	0.0069	0.0339
T-Bill: 3-month	0.5129	0.1946	0.0375	0.0015	0.2535	0.5221	0.0007	0.0233	0.3773	0.0766
T-Bond: 5-year	0.4213	0.1507	0.1888	0.0000	0.2392	0.4165	0.0066	0.0920	0.2857	0.1992
Unemployment rate	0.1290	0.0079	0.8482	0.0082	0.0068	0.0560	0.0007	0.4503	0.0027	0.4902
M1	0.0449	0.0019	0.8057	0.1165	0.0310	0.0080	0.0035	0.8964	0.0094	0.0827
M2	0.0217	0.0147	0.7585	0.1521	0.0530	0.0147	0.0476	0.8948	0.0099	0.0331
Consumer credit	0.2485	0.5305	0.0433	0.0096	0.1682	0.0121	0.6315	0.1031	0.2225	0.0307
Exchange rate: average	0.0054	0.0859	0.1184	0.5797	0.2106	0.1076	0.0544	0.4293	0.4086	0.0000
Commodity price index	0.0894	0.5733	0.2546	0.0245	0.0581	0.5102	0.1174	0.1712	0.0006	0.2006
PPI: finished goods	0.4211	0.2783	0.0775	0.1715	0.0517	0.8623	0.0018	0.1098	0.0199	0.0062
Capacity utilization rate	0.0209	0.4153	0.4204	0.1433	0.0000	0.0215	0.1751	0.0986	0.1221	0.5827
Real Pers. Cons.	0.4883	0.2325	0.2202	0.0586	0.0004	0.1420	0.7432	0.1148	0.0000	0.0000
Real Pers. Cons.: services	0.2617	0.3182	0.0563	0.3330	0.0309	0.0500	0.5713	0.1908	0.0077	0.1802
Avg. unemployment duration	0.2392	0.1296	0.2337	0.3105	0.0871	0.2729	0.0126	0.0132	0.0393	0.6620
Employment	0.1535	0.8330	0.0001	0.0023	0.0111	0.0214	0.8955	0.0380	0.0289	0.0162
Avg weekly hours	0.2865	0.3917	0.2107	0.0823	0.0288	0.0012	0.8450	0.0033	0.0946	0.0560
Avg hourly earnings	0.4023	0.1206	0.0827	0.3693	0.0252	0.1986	0.4286	0.2326	0.0026	0.1376
Housing starts	0.2473	0.5326	0.0021	0.2017	0.0163	0.0072	0.7911	0.1263	0.0686	0.0068
New orders	0.4683	0.4601	0.0032	0.0168	0.0516	0.0214	0.8682	0.0252	0.0615	0.0238
S&P's CCS: dividend yield	0.1896	0.1418	0.5037	0.1147	0.0501	0.0046	0.5323	0.0654	0.1926	0.2051
Consumer expectations	0.8594	0.0285	0.0204	0.0860	0.0057	0.5464	0.3267	0.0137	0.0089	0.1043
FFR	0.5800	0.1644	0.0162	0.0014	0.2380	0.5550	0.0018	0.0137	0.3725	0.0571
B-spread: 10y	0.0878	0.5122	0.3233	0.0714	0.0053	0.0088	0.3386	0.1150	0.0445	0.4932
Real GDP	0.4369	0.5009	0.0614	0.0002	0.0006	0.0318	0.9682	0.0000	0.0000	0.0000
Real GDP: goods	0.3718	0.5570	0.0268	0.0315	0.0127	0.0090	0.9524	0.0306	0.0010	0.0071
Real GDP: services	0.2337	0.1934	0.0032	0.5428	0.0269	0.0881	0.3442	0.1716	0.0306	0.3656
Employees compensation	0.4109	0.5462	0.0000	0.0235	0.0194	0.0377	0.8589	0.0111	0.0465	0.0458
Gov. consumption	0.3737	0.0035	0.1697	0.0764	0.3767	0.4546	0.0234	0.1365	0.3534	0.0322
Investment	0.0430	0.4620	0.2640	0.0578	0.1733	0.0315	0.2964	0.4894	0.1667	0.0160
Invst.: nonresidential	0.1051	0.6244	0.0484	0.0334	0.1887	0.0142	0.5858	0.2318	0.1683	0.0000
GDP deflator	0.7568	0.2173	0.0066	0.0023	0.0170	0.9583	0.0029	0.0326	0.0060	0.0002
PCE deflator	0.6648	0.2671	0.0003	0.0439	0.0239	1.0000	0.0000	0.0000	0.0000	0.0000

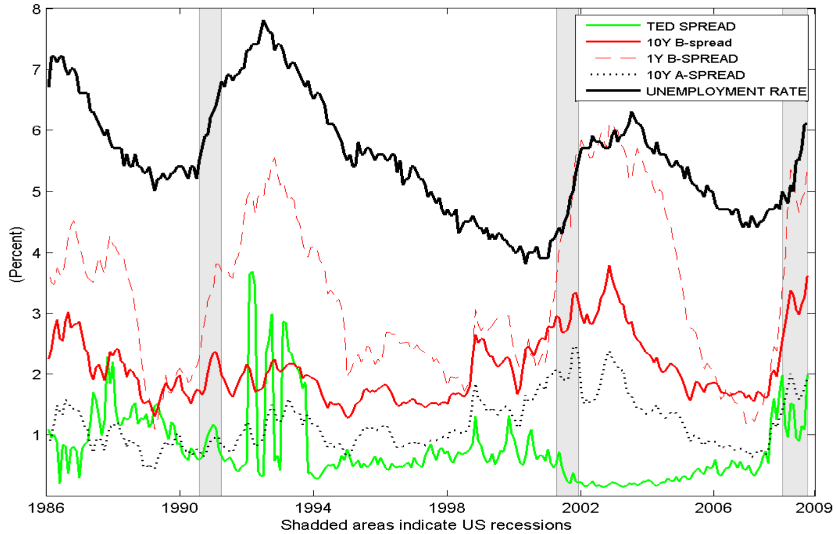

Figure 1: Measures of the external finance premium

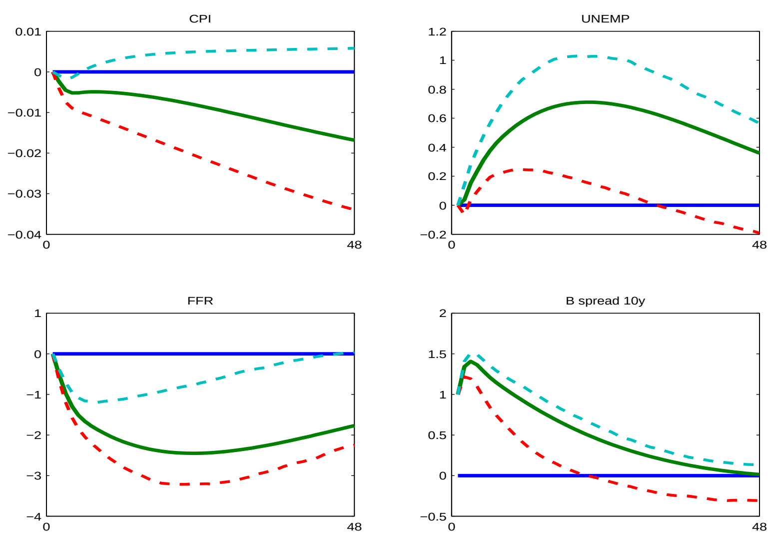

Figure 2: Benchmark model, 100 basic points shock to credit spread

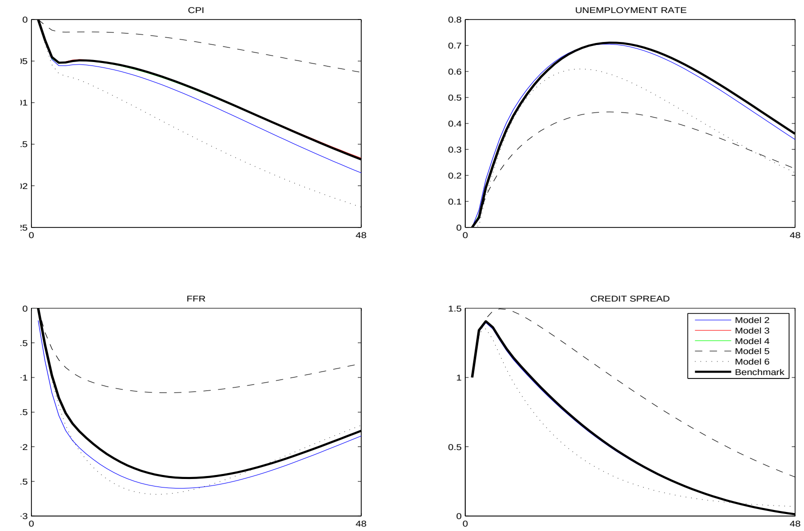

Figure 3: Benchmark model vs models 2-6, 100 basic points shock to credit spread

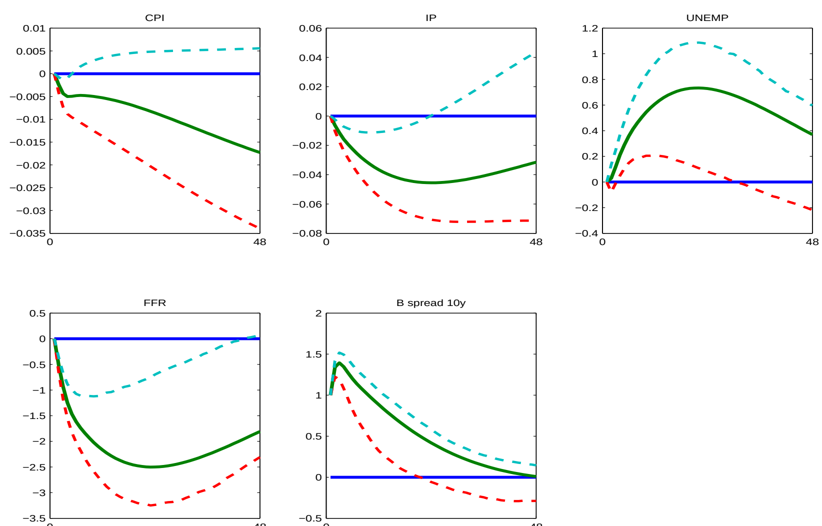

Figure 4: Model 1, 100 basic points shock to credit spread

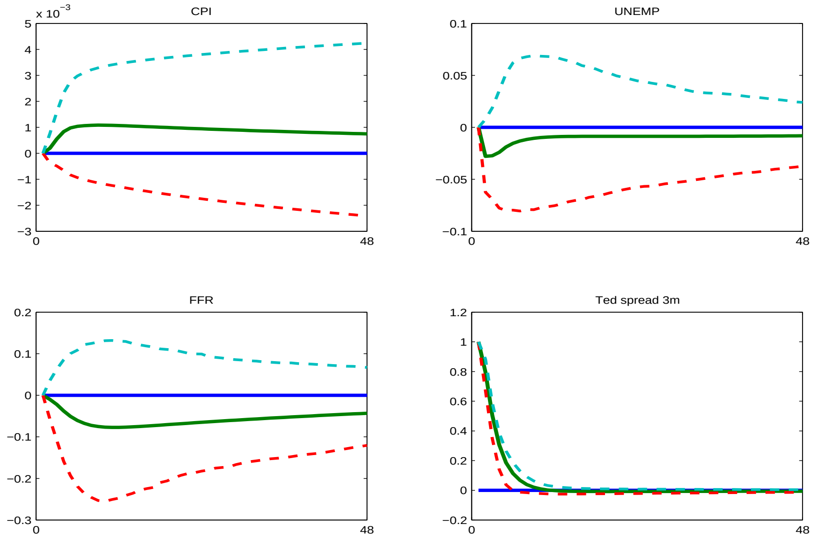

Figure 5: Model 7, 100 basic points shock to Ted spread

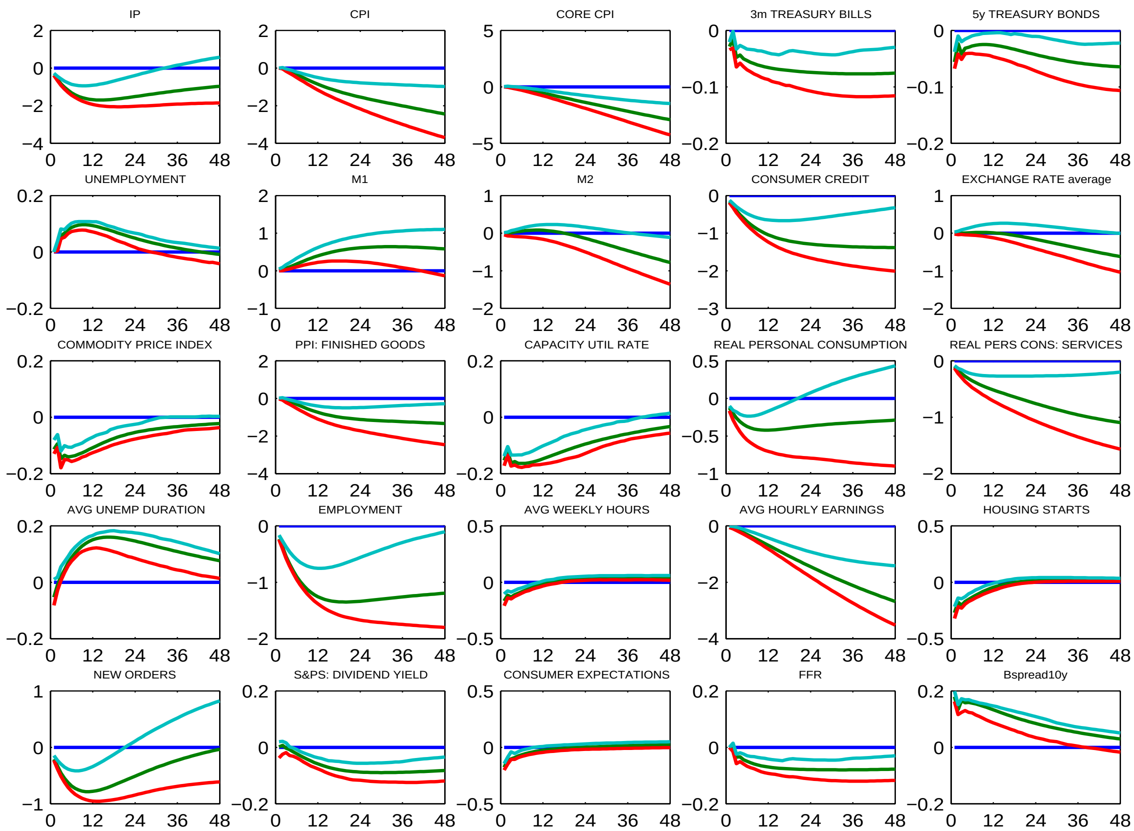

Figure 6: Dynamic responses of monthly variables to credit shock of size 1

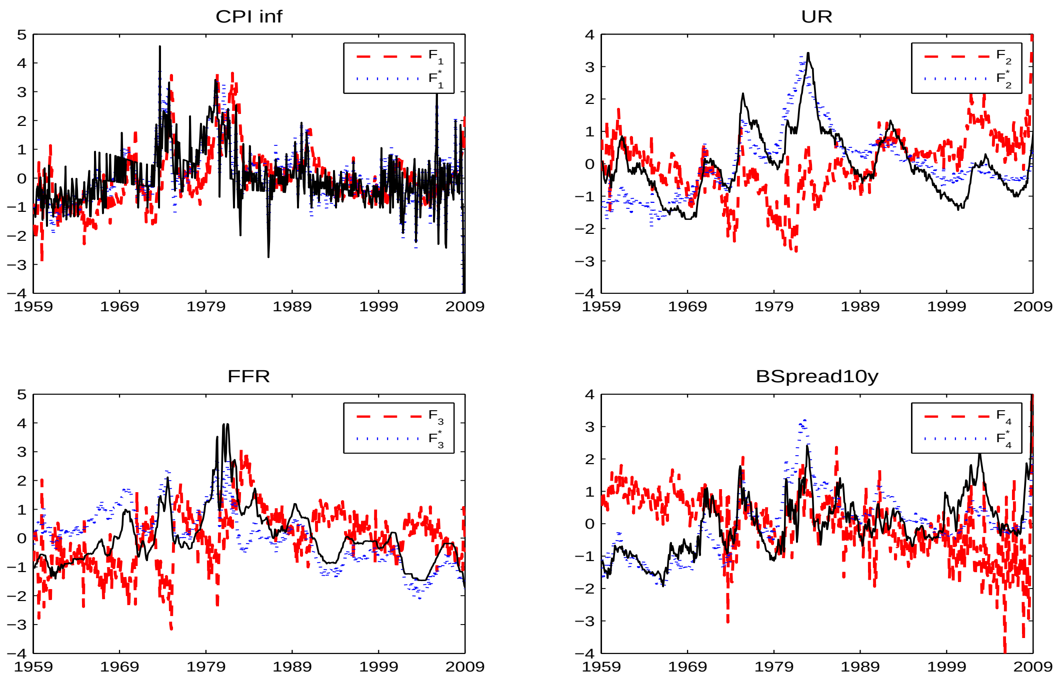

Figure 7: Principal components, rotated factors and variables used in recursive identification with monthly balanced panel

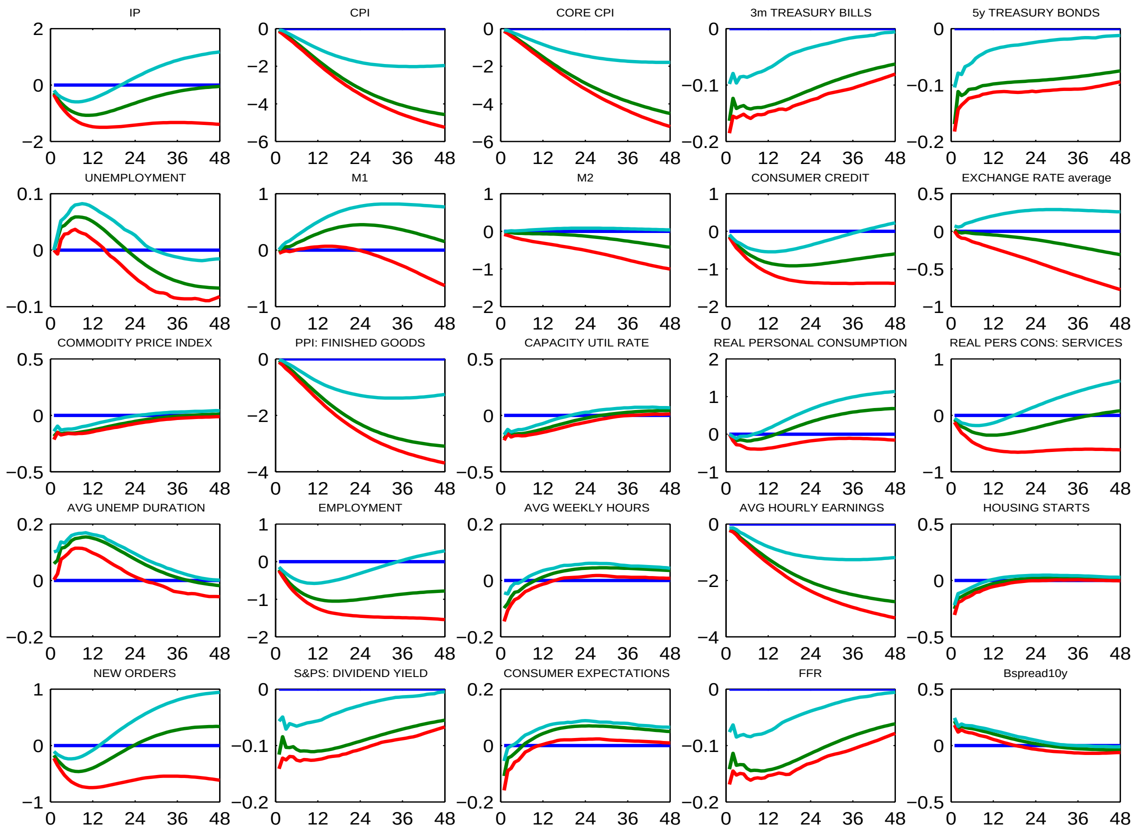

Figure 8: Dynamic responses of monthly variables to credit shock of size 1

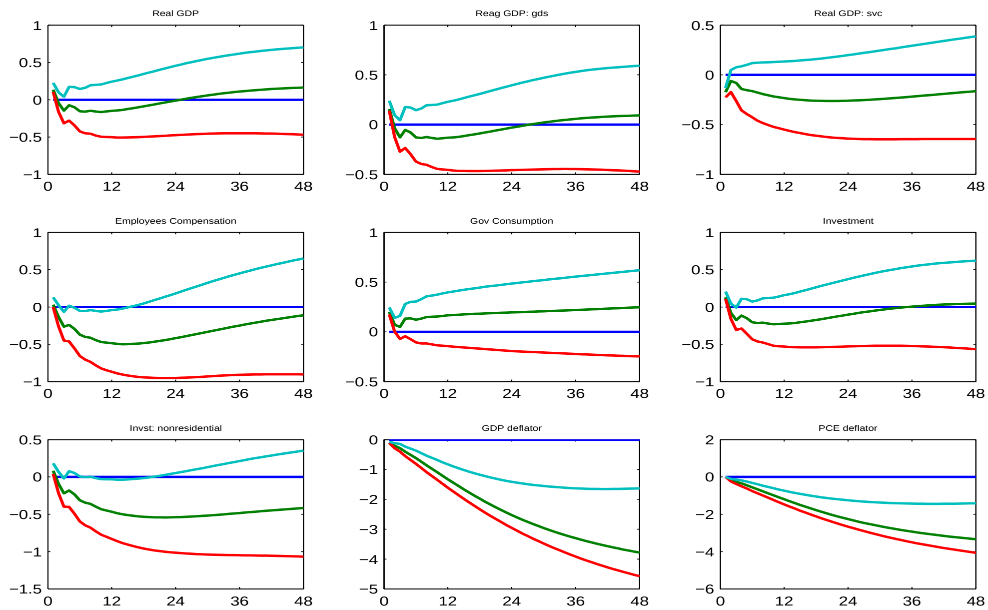

Figure 9: Dynamic responses of constructed monthly indicators to credit shock of size 1

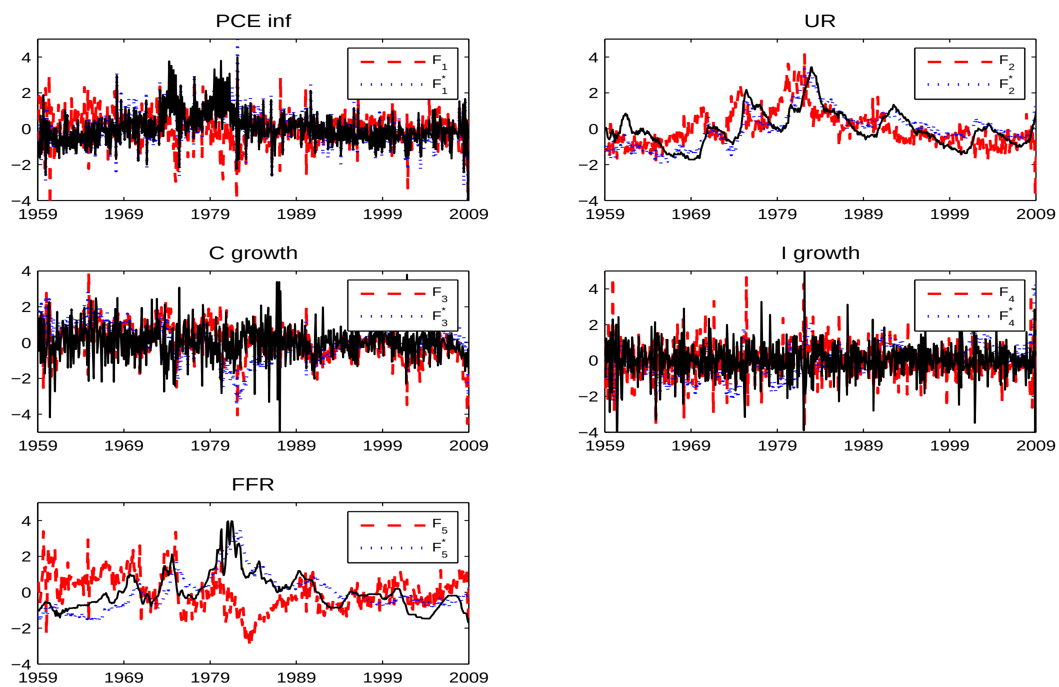

Figure 10: Principal components, rotated factors and variables used in recursive identification with monthly mixed-frequencies data

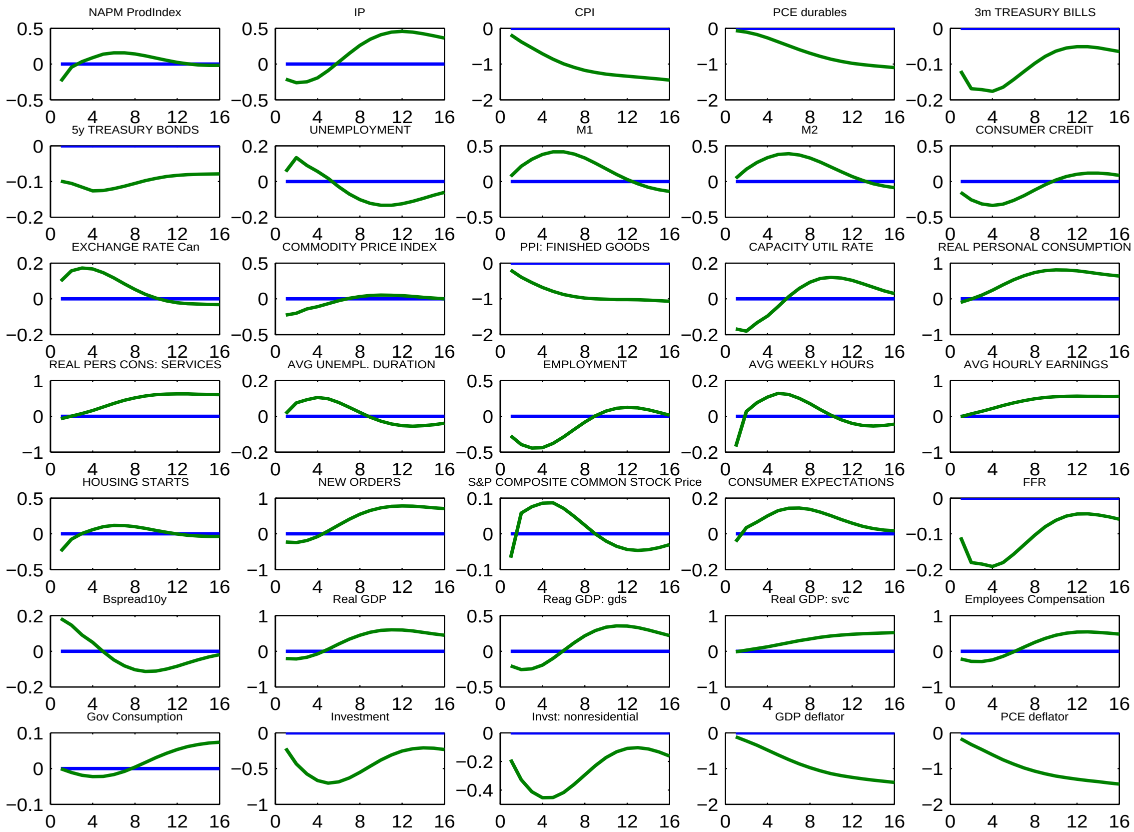

Figure 11: Median IRFs of quarterly selected variables to credit shock of size 1

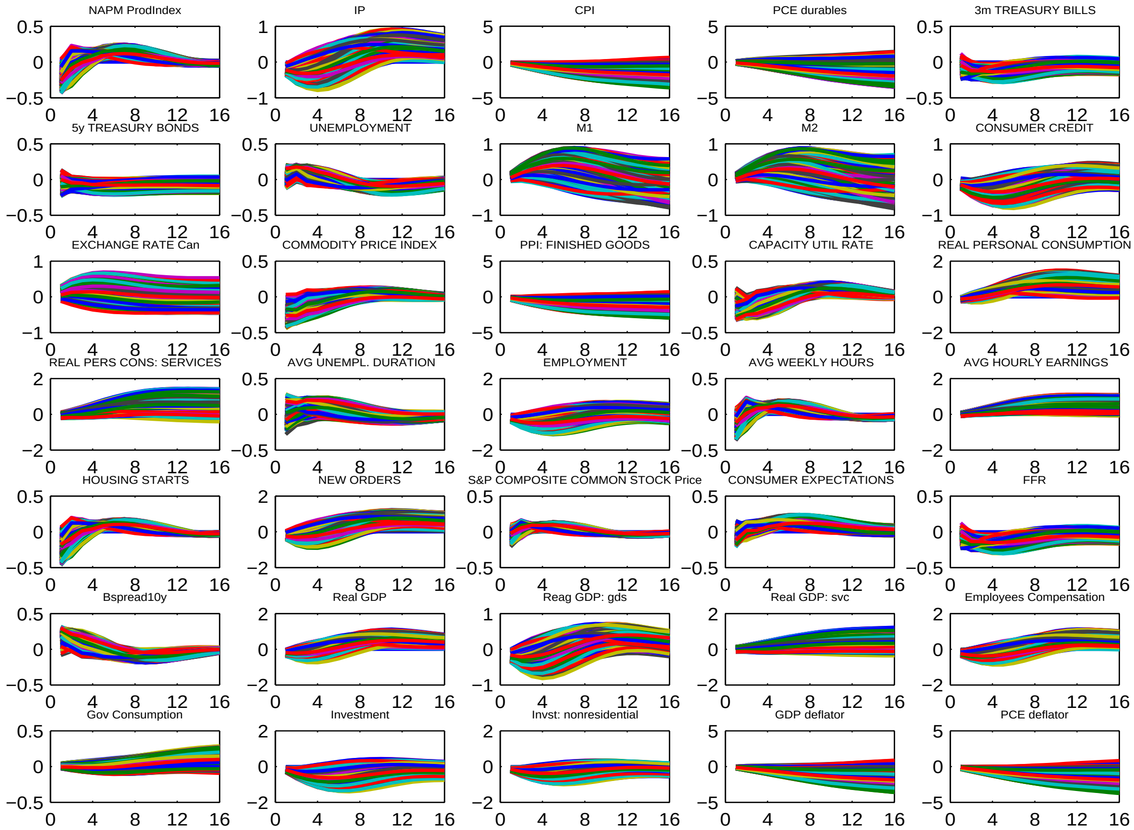

Figure 12: All IRFs satisfying sign restrictions

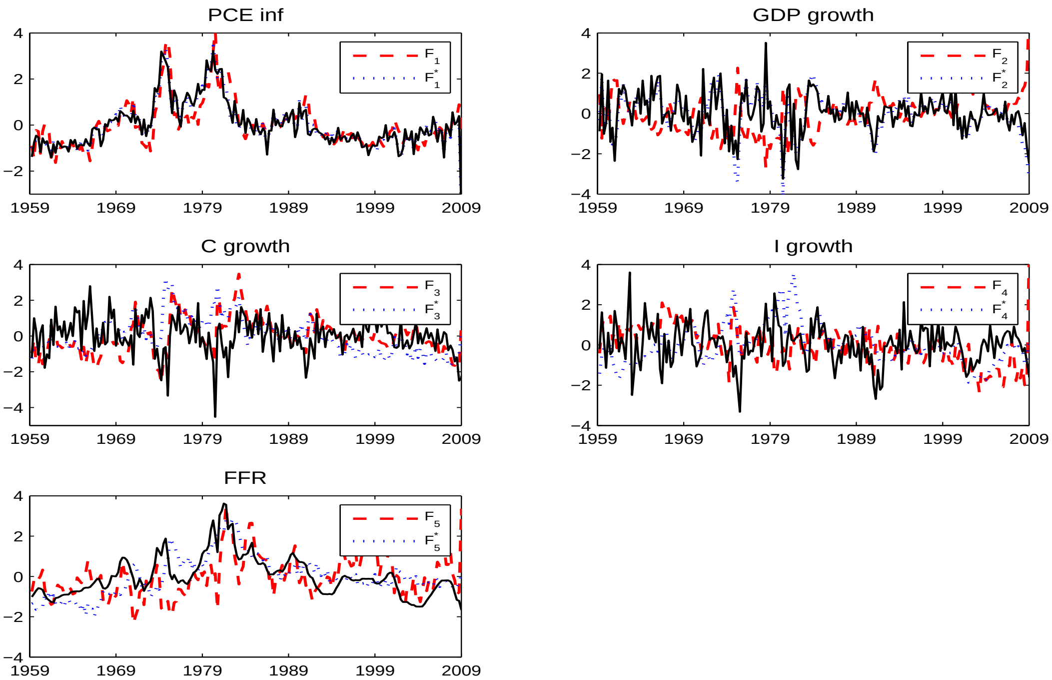

Figure 13: Principal components, rotated factors and variables used in recursive identification with quarterly balanced panel

Appendix A: Dynamic effects of the monetary policy shock

Here, we present the effects of the monetary policy using the same identification scheme as above, and using the monthly balanced panel and the mixed-frequencies monthly panel. In the first specification the monetary policy shock is ordered third, and in the second specification it is the last element of the vector of identified structural shocks.

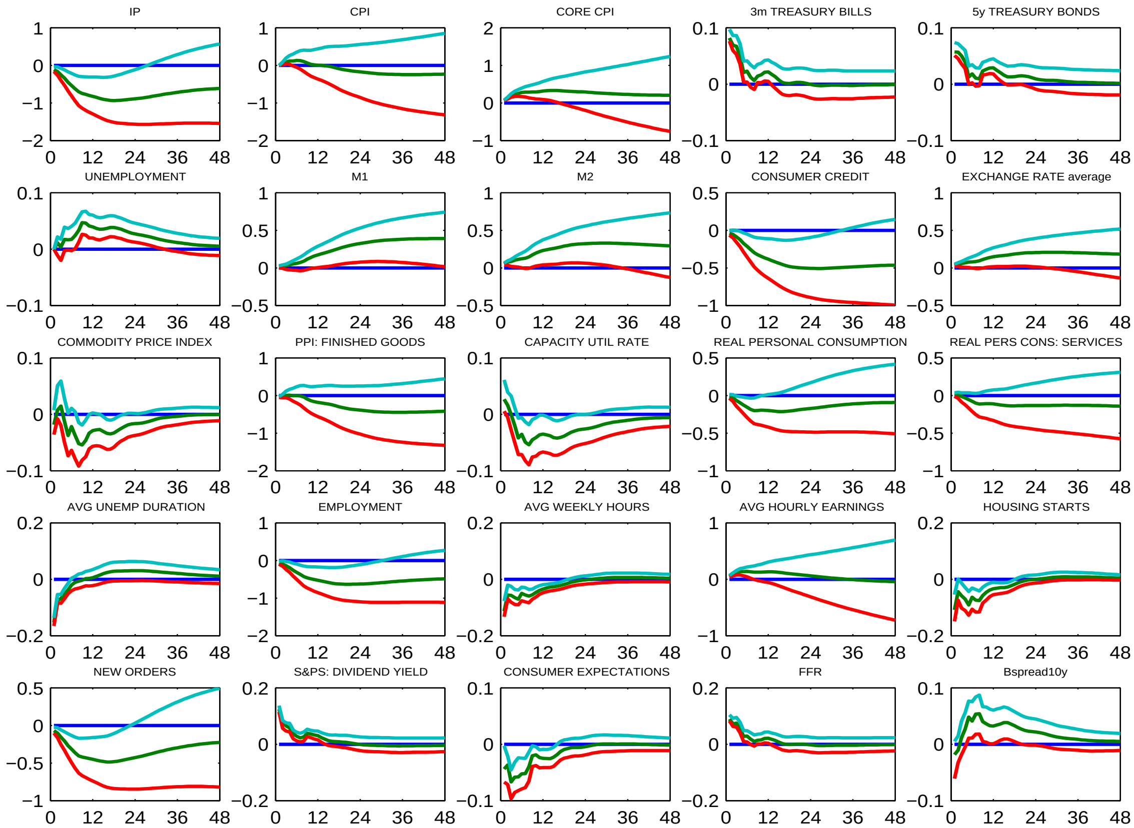

Figure 14: Dynamic responses of monthly variables to monetary policy shock

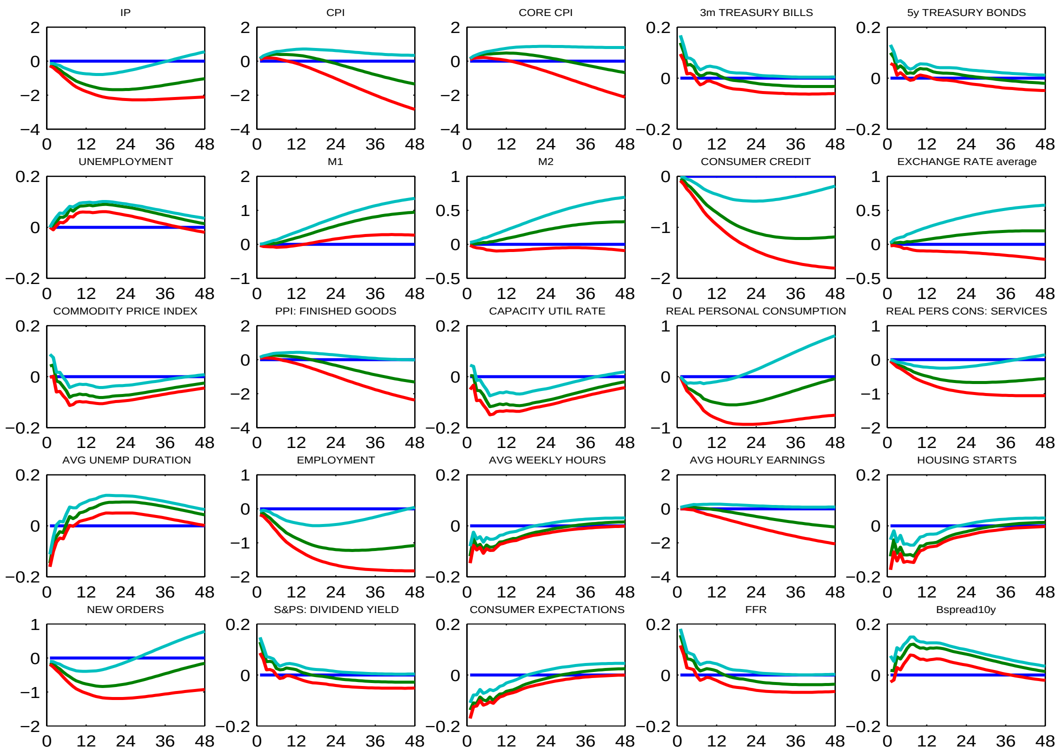

Figure 15: Dynamic responses of monthly variables to monetary policy shock using mixed-frequencies data

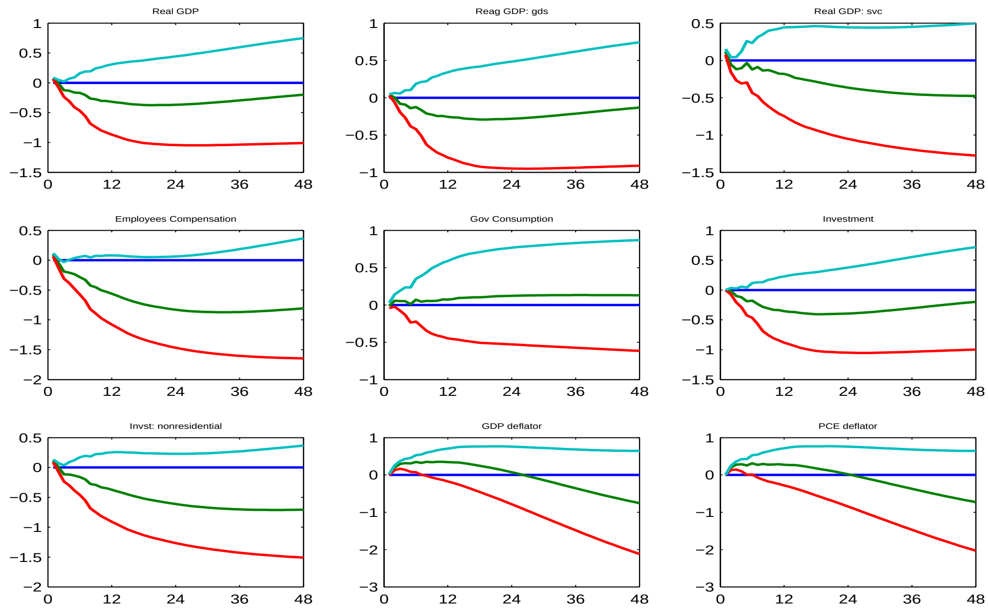

Figure 16: Dynamic responses of constructed monthly indicators to monetary policy shock using mixed-frequencies data

Appendix B: Data Sets

No.	Series Code	T-Code	Series Description
			Real output and income
1	IPS10	5	INDUSTRIAL PRODUCTION INDEX - TOTAL INDEX
2	IPS11	5	INDUSTRIAL PRODUCTION INDEX - PRODUCTS, TOTAL
3	IPS12	5	INDUSTRIAL PRODUCTION INDEX - CONSUMER GOODS
4	IPS13	5	INDUSTRIAL PRODUCTION INDEX - DURABLE CONSUMER GOODS
5	IPS14	5	INDUSTRIAL PRODUCTION INDEX - AUTOMOTIVE PRODUCTS
6	IPS18	5	INDUSTRIAL PRODUCTION INDEX - NONDURABLE CONSUMER GOODS
7	IPS25	5	INDUSTRIAL PRODUCTION INDEX - BUSINESS EQUIPMENT
8	IPS29	5	INDUSTRIAL PRODUCTION INDEX - DEFENSE AND SPACE EQUIPMENT
9	IPS299	5	INDUSTRIAL PRODUCTION INDEX - FINAL PRODUCTS
10	IPS306	5	INDUSTRIAL PRODUCTION INDEX - FUELS
11	IPS32	5	INDUSTRIAL PRODUCTION INDEX - MATERIALS
12	IPS34	5	INDUSTRIAL PRODUCTION INDEX - DURABLE GOODS MATERIALS
13	IPS38	5	INDUSTRIAL PRODUCTION INDEX - NONDURABLE GOODS MATERIALS
14	IPS43	5	INDUSTRIAL PRODUCTION INDEX - MANUFACTURING (SIC)
15	PMP	1	NAPM PRODUCTION INDEX (PERCENT)
16	PMI	1	PURCHASING MANAGERS' INDEX (SA)
17	UTL11	1	CAPACITY UTILIZATION - MANUFACTURING (SIC)
18	YPR	5	PERS INCOME CH 2000 $,SA-US
19	YPDR	5	DISP PERS INCOME,BILLIONS OF CH (2000) $,SAAR-US
20	YP@V00C	5	PERS INCOME LESS TRSF PMT CH 2000 $,SA-US
21	SAVPER	2	PERS SAVING,BILLIONS OF $,SAAR-US
22	SAVPRATE	1	PERS SAVING AS PERCENTAGE OF DISP PERS INCOME,PERCENT,SAAR-US
			Employment and hours
23	LHEL	5	INDEX OF HELP-WANTED ADVERTISING IN NEWSPAPERS (1967=100;SA)
24	LHELX	4	EMPLOYMENT: RATIO; HELP-WANTED ADS:NO. UNEMPLOYED CLF
25	LHEM	5	CIVILIAN LABOR FORCE: EMPLOYED, TOTAL (THOUS.,SA)
26	LHNAG	5	CIVILIAN LABOR FORCE: EMPLOYED, NONAGRIC.INDUSTRIES (THOUS.,SA)
27	LHTUR	1	UNEMPLOYMENT RATE: (
28	LHU14	1	UNEMPLOY.BY DURATION: PERSONS UNEMPL.5 TO 14 WKS (THOUS.,SA)
29	LHU15	1	UNEMPLOY.BY DURATION: PERSONS UNEMPL.15 WKS + (THOUS.,SA)
30	LHU26	1	UNEMPLOY.BY DURATION: PERSONS UNEMPL.15 TO 26 WKS (THOUS.,SA)
31	LHU27	1	UNEMPLOY.BY DURATION: PERSONS UNEMPL.27 WKS + (THOUS,SA)
32	LHU5	1	UNEMPLOY.BY DURATION: PERSONS UNEMPL.LESS THAN 5 WKS (THOUS.,SA)
33	LHU680	1	UNEMPLOY.BY DURATION: AVERAGE(MEAN)DURATION IN WEEKS (SA)
34	LHUEM	5	CIVILIAN LABOR FORCE: UNEMPLOYED, TOTAL (THOUS.,SA)
35	AHPCON	5	AVG HR EARNINGS OF PROD WKRS: CONSTRUCTION ($,SA)
36	AHPMF	5	AVG HR EARNINGS OF PROD WKRS: MANUFACTURING ($,SA)
37	PMEMP	1	NAPM EMPLOYMENT INDEX (PERCENT)
38	CES002	5	EMPLOYEES ON NONFARM PAYROLLS - TOTAL PRIVATE
39	CES003	5	EMPLOYEES ON NONFARM PAYROLLS - GOODS-PRODUCING
40	CES004	5	EMPLOYEES ON NONFARM PAYROLLS - NATURAL RESOURCES AND MINING
41	CES011	5	EMPLOYEES ON NONFARM PAYROLLS - CONSTRUCTION
42	CES015	5	EMPLOYEES ON NONFARM PAYROLLS - MANUFACTURING
43	CES017	5	EMPLOYEES ON NONFARM PAYROLLS - DURABLE GOODS
44	CES033	5	EMPLOYEES ON NONFARM PAYROLLS - NONDURABLE GOODS
45	CES046	5	EMPLOYEES ON NONFARM PAYROLLS - SERVICE-PROVIDING
46	CES048	5	EMPLOYEES ON NONFARM PAYROLLS - TRADE, TRANSPORTATION, AND UTILITIES
47	CES049	5	EMPLOYEES ON NONFARM PAYROLLS - WHOLESALE TRADE
48	CES053	5	EMPLOYEES ON NONFARM PAYROLLS - RETAIL TRADE
49	CES088	5	EMPLOYEES ON NONFARM PAYROLLS - FINANCIAL ACTIVITIES
50	CES140	5	EMPLOYEES ON NONFARM PAYROLLS - GOVERNMENT
51	CES151	1	AVERAGE WEEKLY HOURS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - GOODS-PRODUCING
52	CES153	1	AVERAGE WEEKLY HOURS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - CONSTRUCTION
53	CES154	1	AVERAGE WEEKLY HOURS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - MANUFACTURING
54	CES155	1	AVERAGE WEEKLY HOURS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - MANUFACTURING OVERTIME HOURS
55	CES156	1	AVERAGE WEEKLY HOURS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - DURABLE GOODS
56	CES275	5	AVERAGE HOURLY EARNINGS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - GOODS-PRODUCING
57	CES277	5	AVERAGE HOURLY EARNINGS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - CONSTRUCTION
58	CES278	5	AVERAGE HOURLY EARNINGS OF PRODUCTION OR NONSUPERVISORY WORKERS ON PRIVATE NONFARM PAYROLLS - MANUFACTURING
			Real Consumption
59	JQCR	5	REAL PERSONAL CONS EXP QUANTITY INDEX (200=100), SAAR
60	JQCNR	5	REAL PERSONAL CONS EXP-NONDURABLE GOODS QUANTITY INDEX (200=100), SAAR
61	JQCDR	5	REAL PERSONAL CONS EXP-DURABLE GOODS QUANTITY INDEX (200=100), SAAR
62	JQCSVR	5	REAL PERSONAL CONS EXP-SERVICES QUANTITY INDEX (200=100), SAAR
			Real inventories and orders
63	MOCMQ	5	NEW ORDERS (NET) - CONSUMER GOODS & MATERIALS, 1996 DOLLARS (BCI)
64	MSONDQ	5	NEW ORDERS, NONDEFENSE CAPITAL GOODS, IN 1996 DOLLARS (BCI)
65	PMDEL	1	NAPM VENDOR DELIVERIES INDEX (PERCENT)
66	PMNO	1	NAPM NEW ORDERS INDEX (PERCENT)
67	PMNV	1	NAPM INVENTORIES INDEX (PERCENT)
			Housing starts
68	HUSTSZ	4	HOUSING STARTS: TOTAL NEW PRIV HOUSING UNITS (THOUS.,SAAR)
69	HSFR	4	HOUSING STARTS:NONFARM(1947-58);TOTAL FARM&NONFARM(1959-)(THOUS.,SA
70	HSMW	4	HOUSING STARTS:MIDWEST(THOUS.U.)S.A.

71	HSNE	4	HOUSING STARTS:NORTHEAST (THOUS.U.)S.A.
72	HSSOU	4	HOUSING STARTS:SOUTH (THOUS.U.)S.A.
73	HSWST	4	HOUSING STARTS:WEST (THOUS.U.)S.A.
			Exchange rates
74	EXRCAN	5	FOREIGN EXCHANGE RATE: CANADA (CANADIAN $ PER U.S.$)
75	EXRUK	5	FOREIGN EXCHANGE RATE: UNITED KINGDOM (CENTS PER POUND)
76	EXRUS	5	UNITED STATES;EFFECTIVE EXCHANGE RATE(MERM)(INDEX NO.)
			Price indexes
77	PMCP	1	NAPM COMMODITY PRICES INDEX (PERCENT)
78	PW561	5	PRODUCER PRICE INDEX: CRUDE PETROLEUM (82=100,NSA)
79	PWCMSA	5	PRODUCER PRICE INDEX:CRUDE MATERIALS (82=100,SA)
80	PWFCSA	5	PRODUCER PRICE INDEX:FINISHED CONSUMER GOODS (82=100,SA)
81	PWFSA	5	PRODUCER PRICE INDEX: FINISHED GOODS (82=100,SA)
82	PWIMSA	5	PRODUCER PRICE INDEX:INTERMED MAT.SUPPLIES & COMPONENTS(82=100,SA)
83	PUNEW	5	CPI-U: ALL ITEMS (82-84=100,SA)
84	PUS	5	CPI-U: SERVICES (82-84=100,SA)
85	PUXF	5	CPI-U: ALL ITEMS LESS FOOD (82-84=100,SA)
86	PUXHS	5	CPI-U: ALL ITEMS LESS SHELTER (82-84=100,SA)
87	PUXM	5	CPI-U: ALL ITEMS LESS MIDICAL CARE (82-84=100,SA)
88	PUXX	5	CPI-U: ALL ITEMS LESS FOOD AND ENERGY (82-84=100,SA)
89	PUC	5	CPI-U: COMMODITIES (82-84=100,SA)
90	PUCD	5	CPI-U: DURABLES (82-84=100,SA)
91	PU83	5	CPI-U: APPAREL & UPKEEP (82-84=100,SA)
92	PU84	5	CPI-U: TRANSPORTATION (82-84=100,SA)
93	PU85	5	CPI-U: MEDICAL CARE (82-84=100,SA)
			Stock prices
94	FSDJ	5	COMMON STOCK PRICES: DOW JONES INDUSTRIAL AVERAGE
95	FSDXP	1	S&P'S COMPOSITE COMMON STOCK: DIVIDEND YIELD (% PER ANNUM)
96	FSPCOM	5	S&P'S COMMON STOCK PRICE INDEX: COMPOSITE (1941-43=10)
97	FSPIN	5	S&P'S COMMON STOCK PRICE INDEX: INDUSTRIALS (1941-43=10)
98	FSPXE	1	S&P'S COMPOSITE COMMON STOCK: PRICE-EARNINGS RATIO (%,NSA)
			Money and credit quantity aggregates
99	FM1	5	MONEY STOCK: M1(CURR,TRAV.CKS,DEM DEP,OTHER CK'ABLE DEP)(BIL$,SA)
100	FM2	5	MONEY STOCK:M2(M1+O'NITE RPS,EURO$,G/P&B/D MMMFS&SAV&SM TIME DEP(BIL$,
101	CCINRV	5	CONSUMER CREDIT OUTSTANDING - NONREVOLVING(G19)
			Miscellaneous
102	UOMO83	1	COMPOSITE INDEXES LEADING INDEX COMPONENT INDEX OF CONSUMER EXPECTATIONS UNITS: 1966.1=100 NSA, CONFBOARD AND U.MICH.
			Interest rates and bonds
103	FYGM3	1	INTEREST RATE: U.S.TREASURY BILLS,SEC MKT,3-MO.(% PER ANN,NSA)
104	FYGM6	1	INTEREST RATE: U.S.TREASURY BILLS,SEC MKT,6-MO.(% PER ANN,NSA)
105	FYGT1	1	INTEREST RATE: U.S.TREASURY CONST MATURITIES,1-YR.(% PER ANN,NSA)
106	FYGT10	1	INTEREST RATE: U.S.TREASURY CONST MATURITIES,10-YR.(% PER ANN,NSA)
107	FYGT20	1	INTEREST RATE: U.S.TREASURY CONST MATURITIES,20-YR.(% PER ANN,NSA)
108	FYGT3	1	INTEREST RATE: U.S.TREASURY CONST MATURITIES,3-YR.(% PER ANN,NSA)
109	FYGT5	1	INTEREST RATE: U.S.TREASURY CONST MATURITIES,5-YR.(% PER ANN,NSA)
110	FYPR	1	PRIME RATE CHG BY BANKS ON SHORT-TERM BUSINESS LOANS(% PER ANN,NSA)
111	FYAAAC	1	BOND YIELD: MOODY'S AAA CORPORATE (% PER ANNUM)
112	FYAAAM	1	BOND YIELD: MOODY'S AAA MUNICIPAL (% PER ANNUM)
113	FYAC	1	BOND YIELD: MOODY'S A CORPORATE (% PER ANNUM,NSA)
114	FYAVG	1	BOND YIELD: MOODY'S AVERAGE CORPORATE (% PER ANNUM)
115	FYBAAC	1	BOND YIELD: MOODY'S BAA CORPORATE (% PER ANNUM)
116	SFYGM3	1	FYGM3-FYFF
117	SFYGM6	1	FYGM6-FYFF
118	SFYGT1	1	FYGT1-FYFF
119	SFYGT5	1	FYGT5-FYFF
120	SFYGT10	1	FYGT10-FYFF
121	SFYAAAC	1	FYAAAC-FYFF
122	SFYBAAC	1	FYBAAC-FYFF
123	FYFF	1	INTEREST RATE: FEDERAL FUNDS (EFFECTIVE) (% PER ANNUM,NSA)
124	Bspread10Y	1	FYBAAC-FYGT10
			Quarterly indicators
125	GDPRC@US.Q	5	NIA REAL GROSS DOMESTIC PRODUCT (CHAINED-2000), SA - U.S.
126	GDPGDR.Q	5	REAL GDP-GDS,BILLIONS OF CH (2000) $,SAAR-US
127	GDPSVR.Q	5	REAL GDP-SVC,BILLIONS OF CH (2000) $,SAAR-US
128	GDPSR.Q	5	REAL GDP-STRUC,BILLIONS OF CH (2000) $,SAAR-US
129	WS@US.Q	5*	NIA NOMINAL TOTAL COMPENSATION OF EMPLOYEES, SA - U.S.
130	CR.Q	5	REAL PCE,BILLIONS OF CH (2000) $,SAAR-US
131	JQCDR.Q	5	REAL PCE-DUR,QTY INDEX (2000=100),SA,SA-US
132	UJQCDMVR.Q	5	REAL PCE-DUR-MV&PARTS,QTY INDEX (2000=100),SA,SA-US
133	JQCDFHER.Q	5	REAL PCE-DUR-FURN&HH EQUIP,QTY INDEX (2000=100),SA,SA-US
134	JQCDOR.Q	5	REAL PCE-DUR-OTH,QTY INDEX (2000=100),SA,SA-US
135	JQCNR.Q	5	REAL PCE-NDUR,QTY INDEX (2000=100),SA,SA-US
136	JQCNFR.Q	5	REAL PCE-NDUR-FOOD,QTY INDEX (2000=100),SA,SA-US
137	JQCNCSR.Q	5	REAL PCE-NDUR-CLO&SHOES,QTY INDEX (2000=100),SA,SA-US
138	JQCNER.Q	5	REAL PCE-NDUR-GASOLINE FUEL OIL&OTH ENERGY GDS,QTY INDEX (2000=100),SA,SA-US
139	JQCNEGAOR.Q	5	REAL PCE-NDUR-GASOLINE FUEL OIL&OTH ENERGY GDS-GASOLINE&OIL,QTY INDEX (2000=100),SAAR-US
140	JQCNEFACR.Q	5	REAL PCE-NDUR-GASOLINE FUEL OIL&OTH ENERGY GDS-FUEL OIL&COAL,QTY INDEX (2000=100),SAAR-US
141	JQCNOR.Q	5	REAL PCE-NDUR-OTH,QTY INDEX (2000=100),SA,SA-US
142	JQCSVR.Q	5	REAL PCE-SVC,QTY INDEX (2000=100),SA,SA-US
143	JQCSVHSR.Q	5	REAL PCE-SVC-HOUSING,QTY INDEX (2000=100),SA,SA-US
144	JQCSVHOPR.Q	5	REAL PCE-SVC-HH OPS,QTY INDEX (2000=100),SA,SA-US
145	JQCSVHOPEAGR.Q	5	REAL PCE-SVC-HH OPS-ELEC&GAS,QTY INDEX (2000=100),SA,SA-US
146	JQCSVHOPOR.Q	5	REAL PCE-SVC-OTH HH OPS,QTY INDEX (2000=100),SA,SA-US
147	JQCSVTSR.Q	5	REAL PCE-SVC-TRNSPRT,QTY INDEX (2000=100),SA,SA-US

148	JQCSVMR.Q	5	REAL PCE-SVC-MEDICAL CARE,QTY INDEX (2000=100),SA,SA-US
149	JQCSVRECR.Q	5	REAL PCE-SVC-RECR,QTY INDEX (2000=100),SA,SA-US
150	JQCSVOR.Q	5	REAL PCE-SVC-OTH,QTY INDEX (2000=100),SA,SA-US
151	JQCENERGYR.Q	5	REAL PCE-ENERGY GDS&SVC,QTY INDEX (2000=100),SAAR-US
152	JQCXFAER.Q	5	REAL PCE EX FOOD&ENERGY,QTY INDEX (2000=100),SAAR-US
153	CGRC@US.Q	5	NIA REAL GOVERNMENT CONSUMPTION EXPENDITURE & GROSS INVESTMENT (CHAINED-2000), SA - U.S.
154	I.Q	5*	GROSS PRIV DOM INVEST,BILLIONS OF $,SAAR-US
155	IF.Q	5*	GROSS PRIV DOM INVEST-FIXED,BILLIONS OF $,SAAR-US
156	IFNRE.Q	5*	GROSS PRIV DOM INVEST-FIXED NONRES,BILLIONS OF $,SAAR-US
157	IFNRES.Q	5*	GROSS PRIV DOM INVEST-FIXED NONRES-STRUC,BILLIONS OF $,SAAR-US
158	IFNRESC.Q	5*	PRIV FIXED INVEST-NONRES-STRUC-COML&HEALTH CARE,BILLIONS OF $,SAAR-US
159	IFNRESMFG.Q	5*	PRIV FIXED INVEST-NONRES-STRUC-MFG,BILLIONS OF $,SAAR-US
160	IFREE.Q	5*	PRIV FIXED INVEST-EQUIP,BILLIONS OF $,SAAR-US
161	IFRESPEMF.Q	5*	PRIV FIXED INVEST-RES-STRUC-MFAM,BILLIONS OF $,SAAR-US
162	IFRESPESF.Q	5*	PRIV FIXED INVEST-RES-STRUC-1 FAM,BILLIONS OF $,SAAR-US
163	IFRESPE.Q	5*	PRIV FIXED INVEST-RES-STRUC-PERMANENT SITE,BILLIONS OF $,SAAR-US
164	IFRES.Q	5*	PRIV FIXED INVEST-RES-STRUC,BILLIONS OF $,SAAR-US
165	IFRE.Q	5*	GROSS PRIV DOM INVEST-FIXED RES,BILLIONS OF $,SAAR-US
166	IFNREEO.Q	5*	GROSS PRIV DOM INVEST-FIXED-NONRES-EQUIP&SW-OTH,BILLIONS OF $,SAAR-US
167	IFNREET.Q	5*	GROSS PRIV DOM INVEST-FIXED-NONRES-EQUIP&SW-TRNSPRT,BILLIONS OF $,SAAR-US
168	IFNREEIND.Q	5*	GROSS PRIV DOM INVEST-FIXED-NONRES-EQUIP&SW-IND,BILLIONS OF $,SAAR-US
169	IFNREEIPO.Q	5*	GROSS PRIV DOM INVEST-FIXED-NONRES-EQUIP&SW-INFO PROC&SW-OTH,BILLIONS OF $,SAAR-US
170	IFNREEIPCS.Q	5*	GROSS PRIV DOM INVEST-FIXED-NONRES-EQUIP&SW-SW,BILLIONS OF $,SAAR-US
171	IFNREEIPCC.Q	5*	GROSS PRIV DOM INVEST-FIXED-NONRES-EQUIP&SW-COMP&PERI,BILLIONS OF $,SAAR-US
172	IFNREEIP.Q	5*	GROSS PRIV DOM INVEST-FIXED-NONRES-EQUIP&SW-INFO PROC,BILLIONS OF $,SAAR-US
173	IFNREE.Q	5*	GROSS PRIV DOM INVEST-FIXED NONRES-EQUIP#&SW,BILLIONS OF $,SAAR-US
174	IFNRESO.Q	5*	PRIV FIXED INVEST-NONRES-OTH STRUC,BILLIONS OF $,SAAR-US
175	IFNRESMI.Q	5*	PRIV FIXED INVEST-NONRES-STRUC-MINING EXPLORATION,SHAFTS,&WELLS,BILLIONS OF $,SAAR-US
176	IFNRESP.Q	5*	PRIV FIXED INVEST-NONRES-STRUC-POWER&COMM,BILLIONS OF $,SAAR-US
177	II.Q	1	GROSS PRIV DOM INVEST-CH IN PRIV INVENT,BILLIONS OF $,SAAR-US
178	IIF.Q	1	GROSS PRIV DOM INVEST-CH IN PRIV INVENT-FARM,BILLIONS OF $,SAAR-US
179	M.Q	5	IMPORTS OF GDS&SVC,BILLIONS OF $,SAAR-US
180	X.Q	5	EXPORTS OF GDS&SVC,BILLIONS OF $,SAAR-US
181	PGDP@US.Q	5	NIA PRICE DEFLATOR - GROSS DOMESTIC PRODUCT, SA - U.S.
182	PCP@US.Q	5	NIA PRICE DEFLATOR - PRIVATE CONSUMPTION EXPENDITURE, SA - U.S.