Financial Condition Index and interest rate settings: a comparative analysis

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Abstract: In the last thirty years, there has been a widespread move towards financial liberalisation, both within and across national borders. This economic development brought researchers to investigate the link between asset prices, inflation and the conduct of monetary policy. Stating from the seminal work of Alchian and Klein (1973) it is often argued that the forward-looking nature of asset prices makes them good proxies for the information left out of conventional inflation measures. It is also widely accepted that asset price inflation developments are closely associated with general inflation trends. This paper investigates the role of asset prices in the conduct of monetary policy in United States, Canada and the Euro Area. It has two focal points. First, we construct Financial Condition Indexes for four countries using the Kalman Filter algorithm. This methodology allows us to capture the changes of the weights associated with each financial variable in explaining the output gap over time. Second, we proceed by estimating forward-looking Taylor rules augmented for FCI. Our results suggest that the Financial Condition Index enter positively and statistically significant into the FED, ECB and Bank of Canada interest rate settings. This gives a positive view for the use of the FCI as an important short term indicator to guide the conduct of monetary policy in three out of four countries analyzed.

Keywords: Financial Condition Index, Optimal Monetary Policy, Taylor rule.

JEL Classification: E52, E58, G12

1. Introduction

Alchian and Klein (1973) were the first to assert that focusing only on the Consumer Price Index as an indicator of inflation could be misleading because it reflects only the change in prices in the real sector. Monetary authorities should also consider inflation from the financial sector. This view has recently been strengthened by developments in capital markets and the new environment hypothesis, as suggested by Borio and Lowe (2002)[1]. They argue that the presence of a credible stabilisation program, an improved supply side[2] and a credible monetary policy could create a favourable ground for financial instability. High levels of monetary credibility lead to well-anchored inflation expectations, and this, in turn, has led to many economic benefits. Borio and Lowe (2002) though argue that there is a potential problem here. People can come to believe that the Central Bank will always be able to guard against swings in inflation or downturns in the economy. At the same time investors could believe that the central bank would take decisive action to prevent the stock market from falling but not from rising Miller et al (2001).

Starting from the above considerations the purpose of this paper is twofold. In the first part; we suggest a methodology in order to account for the impact of financial markets on real output; we build a Financial Condition Index for the four countries using the Kalman Filter algorithm. This methodology allows us to capture the changes of the weights of each financial variable in explaining the output gap. In the second part we analyze the interactions between FCIs and monetary policy in three countries: United States of America (US), Canada (CA) and European Monetary Union's countries (EU). We estimate forward-looking Taylor rules augmented for FCI in order to analyze the Central Bank's reaction to a misalignment in the asset markets. This analysis will be undertaken in the contest of a simple backward looking model of the economy described by the aggregate demand – aggregate supply framework. The standard and augmented Taylor rule will be used to define the optimal monetary policy. The concept of FCI and the way it is constructed are fundamental in the evaluation of the resulting policy rules that will emerge under

[1] See also Borio, English and Lowe (2002)
[2] They are identified as improvements in the technology, labour market reforms, and productivity gains.

different behavioral assumptions regarding the sensitivity of the monetary authorities to respond to a misalignment in the asset markets.

The structure of the paper is as follows: section 2 reviews the literature. The construction of the FCI and the results for the four countries are derived in section 3. Section 4 proceeds by estimating forward-looking Taylor rules augmented for FCI and present the empirical results. Section 5 concludes.

2. Monetary Policy and Asset Prices, an overview

An important aspect emerging from the literature is the role played by asset prices during the monetary transmission mechanism. They, in fact, may contain important information regarding the current and future state of the economy. In fact, changes in interest rate modify people's expectations about future economic growth, and thus their wealth expectations. This may change the set of discount factors economic agents apply to their profit expectations or to the future stream of services or revenues from the asset they hold (housing for instance).

This analysis put forward the case for a reaction of monetary authorities to asset prices movements. There are several reasons why monetary policy might wish to respond; a first reason is that asset prices misalignments may endanger the stability of the financial system. This case is put forward by Borio and Lowe (2002), they observe that since the 1970s asset prices cycles have been growing in amplitude and size. They argue that even in an environment characterised by sound and credible economic policies, financial instability could be a serious threat. According to them, "it is the unwinding of financial imbalances that is the major source of financial instability, not an unanticipated decline in inflation per se". In the second chapter we will analyse the 1990 recession and highlight the important role played by the accumulation of these imbalances (debt); and in the fourth chapter we look at this issue in more detail discussing the Borio and Lowe (2002) position. A second potential reason why central banks would like to respond to asset prices is that, as analysed previously, they play an important role in the transmission of monetary policy. Rising asset prices may have a direct impact on the aggregate demand and may, therefore, be associated with growing inflationary pressures. They also influence the collateral values and bank's willingness to lend. The final reason is that asset prices might contain important information concerning the future state of the economy; they incorporate information about financial market expectation of inflation and macroeconomic conditions.

The major debate is not on the role of asset prices in the economy, but rather if and eventually how policy makers (i.e. Central Banks) should take into consideration information deriving from the asset market. In the literature we can identify three views: the first states that assets prices should be considered but only as one of the variables used to forecast inflation. Bernanke and Gertler (1999) argue that when monetary policy operate within a logic of flexible inflation target, it should ignore movements in asset prices that do not appear to be generating inflationary or deflationary pressures. Changes in asset prices should affect monetary policy only to the extent that they affect the central bank's forecast of inflation; once the predictive content of asset prices for inflation has been accounted for, there should be no additional response of monetary policy to asset-price fluctuations. By focusing on the inflationary or deflationary pressures generated by asset price movements, a central bank effectively responds to the "*toxic*" side of asset booms and busts without getting into the business of deciding what a fundamental is and what is not. Bernanke and Gertler (1999, 2001) argue that the potential costs of responding to asset price can be quite large because asset prices can be too volatile relative to their information content. In fact, Bernanke and Gertler (2001) show that a too-aggressive response to a stock price bubble can create significant harm in the economy. Batini and Nelson (2000) find an analogous result for bubbles in the real exchange rate.

A second view is expressed by Goodhart (1999)[3]. He believes that the Central Bank should target a broader price index which includes asset prices. This measure has the potential to improve macroeconomic performance if asset prices reliably predict future consumer price inflation. The theoretical foundation of Goodhart's

[3] Goodhart (2001) writes: "So long as asset price changes are not incorporated in the measure of inflation which the authorities are required to stabilize, the authorities are likely to express audible worries about 'exuberance' and 'sustainability', but in practice find themselves largely incapable of any (pre-emptive) action in response to asset price change themselves in advance of any (consequential) effects coming through onto current goods and services prices, paralysed in practice".

recommendation is based on the pioneering research on the theory of inflation measurement by Alchian and Klein (1973). They argue that since asset prices represent the current money prices of claims on future, as well as current, consumption, an accurate measure of inflation should include asset prices. They also argued that asset prices can serve as good proxies for the inflation information left out of conventional measures. Using a VAR methodology they find that the Financial Condition Index is a useful instrument to forecast in-sample future inflation[4]. If a Central Bank were to follow Goodhart's recommendation and use this broader measure of inflation, an increase in asset price inflation could prompt tighter monetary policy even if conventionally measured inflation were low and stable. As Filardo (2000) argued though, this policy implication depends on the strong assumption that asset price inflation accurately reflects future consumer price inflation.

The third view is that asset prices should be made an integral part of monetary policy; in this case, monetary authorities should try to act to stabilize their value around the fundamentals. Cecchetti, *et al.* (1999) argue that a central bank concerned in stabilizing inflation about a specific target level is likely to achieve superior performance by adjusting its policy instruments not only in response to its forecast of future inflation and the output gap as the traditional Taylor rule would suggest, but to asset prices as well. They demonstrate that monetary policymakers should react to perceived misalignments in asset prices to reduce the likelihood of asset price bubbles forming. More generally Cecchetti (2000, p.24) analyzing objectives and rule of monetary policy makers reach the conclusion that a *complex* rule is always more advisable than a *simple* Taylor rule. He states that "there is no reason to believe that information on output and inflation is always capable of adequately summarizing what policy needs to do to respond to the shocks hitting the economy". Bernanke and Gertler (2001) are very critical of Cecchetti *et al.* (1999) methodology. They argue that if Cecchetti *et al.* had accounted for stochastic, instead of deterministic, asset price bubbles, and also if they allow for the possibility that shocks other than a bubble may be driving asset prices, they would have found no useful role for asset prices

[4] Out-of sample results do not seem to provide satisfactory results.

beyond that that is reflected in expectations for future inflation[5]. Filardo (2001) shows that while there are benefits for the monetary authority to respond to asset price changes even when it cannot distinguish between the "bubble" and the "fundamental" part of the asset price inflation, the monetary authority's desire to respond to asset prices falls dramatically as its preference to smooth interest rates rises. He argues that even though asset prices contain useful information about inflation and output, the cost in terms of interest rate volatility can be so high as to cause the monetary authority to largely disregard the information. This result is consistent with Bernanke and Gertler's conclusion that by responding to stock prices, a central bank could worsen economic outcomes. In another paper Filardo (2000) concludes that a monetary authority generally benefits from responding to asset prices only as long as there is no uncertainty about the macroeconomic role of asset prices. If the monetary authority is uncertain about whether asset prices have an independent role in the context of a macro-model or simply reflecting other economic fundamentals, then the expected costs in terms of economic volatility of responding to asset prices may exceed the expected benefits.

Considering the above discussion, in the next section we construct an indicator which capture misalignments in the asset market and it could be used by monetary authorities as part of in their information set or as a target.

3. Constructing the FCI

Constructing a Financial Condition Index is a no easy task, as many authors before us have highlighted[6]. Such a variable should be able to capture the current development of financial markets and, at the same time, it should give a good indication of future economic activity. Moreover a correctly estimated FCI should "provide(s) continuously updated information about the future, whereas traditional economic

[5] Cecchetti *et al.* "optimize" the policy rule with respect to a single scenario, a bubble shock lasting precisely five periods, rather than with respect to the entire probability distribution of shocks, including shocks other than bubble shocks. Effectively, their procedure yields a truly optimal policy only if the central bank knows with certainty that the stock market boom is driven by non-fundamentals and knows exactly when the bubble will burst, both highly unlikely conditions.
[6] See Goodhart and Hoffman (2001) and Mayes and Viren (2001).

forecasts are only updated monthly or quarterly (or half yearly in the case of the published Eurosystem forecast)" Mayes and Viren (2001, p.8)[7]

In general, the FCI provides useful information about inflation and monetary policy. However, Grande (1997) stressed not only the problem of how to extrapolate the relevant information from a composite index but also the problem of the additional assumptions required to implement it. We will construct an indicator which has the characteristics described above.

The first step of our analysis we construct an aggregate measure of a Financial Conditions Index. We will focus our analysis on four assets: short-term interest rate, the real effective exchange rate, real house prices and real share prices[8]. In this section we explain how FCIs can be derived and how FCIs can be used, especially by Central Banks, in formulating their monetary policy. In order to construct an FCI, the first problem to face is how to determine the weight of the single asset. Goodhart and Hofmann (2001) propose three different methodologies: first they simulate a large scale macro-econometric model; then they implement a system with reduced-form aggregate demand equations; and finally they analyse VAR impulse responses. They found that, except for Germany and the UK, both approaches are very similar. However, there is a problem related with the different analyses proposed: despite the size of the sample used, the weight associated with each financial variable is fixed. In fact it is likely that firms and households portfolios change with the business cycles or in the presence of particular events. In the present work, we will try to overcome this problem proposing an alternative way to calculate the weight of each single asset. We use a Kalman Filter algorithm in order to capture the changes of the weights over time.

Following the pioneering contribution of Alchian and Klein (1973) and more recently Eika et al. (1997), Mayes and Viren (1998), Goodhart (2000), Mayes and Viren

[7] It is beyond the aim of this paper to discuss why the FCIs are superiors to other financial variables, for instance Monetary Condition Indexes; for a discussion on this issue see Smets (1997) and Mayes and Viren (2001).

[8] Mayes and Viren (2001) present an accomplished description of the choice of different assets used in the past papers (see also Goodhart and Hofmann (2001), Goldman and Sachs (2001), Mayes and Viren (1998) and Eika et al. (1997)) and the dissimilar approaches to the FCIs based on the transmission mechanism's problems.

(2001) and Goodhart and Hofmann (2001), we formulate a formal model of the economy in order to show the importance of financial variables in the conduct of monetary policy. In doing this, we present a simple model which is the equivalent of a conventional backward looking aggregate demand –aggregate supply augmented with the asset markets (an extender version of Redebusch and Svensson (1998) as suggested by Goodhart and Hofmann (2001)):

$$\pi_t = \phi_1 + \sum_{i=1}^{k_1} \phi_{1,i}\pi_{t-i} \sum_{j=1}^{k_2} \phi_{2,j}\, y_{t-j} + \eta_t \tag{1}$$

$$y_t = \beta_1 + \sum_{i=1}^{g_1} \beta_{1,i}\, y_{t-i} + \sum_{j=1}^{g_2} \beta_{2,j} ri_{t-j} + \sum_{l=1}^{g_3} \beta_{3,j} re_{t-l} \sum_{n=1}^{g_4} \beta_{4,j} rh_{t-n} \sum_{m=1}^{g_5} \beta_{5,j} rs_{t-m} + \mu_t \tag{2}$$

where π_t is equal to $100*[\ln(CPI_t/CPI_{t-12})]$, where CPI is the consumer Price Index, and HCPI for the EUM; and the output gap (y_t) is the difference between actual and potential output, is calculated as the percentage deviation of the natural logarithm of the monthly industrial production from a Hodrick-Prescott trend; The financial markets are proxied by four variables: *ri, rh,re, rs*. They are, respectively, the percent gap between the real and potential interest rate, real effective exchange rate, real house price and real stock price. We calculate the long-term of the assets prices using the above Hodrick-Prescott filter methodology[9]. The choice of this sample is essentially based on the need of including all the main events that determine substantial changes in government and monetary policies. The choice of inflation targeting (Canada February 1991 3%) and the born of the EMU (1998) are only a few but significant examples of these changes. In light of this, for most of the countries the sample 1989-2003 was chosen.

The construction of the FCIs is divided in two steps. The first consists of estimating Eq. (2) using the Kalman filter algorithm; the second step refers to the definition of the index using the time varying coefficients.

[9] Appendix 3 presents the sources of the variables.

For the purposes of the analysis the most important aspect is given by the value of the coefficients of Eq. (2). These coefficients represent an adjustment mechanism in the asset gaps. They evolve over time, hence, the potential relevance of an unobservable change in the $\beta_{i,t}$ induce us to estimate Eq. (2) in its state space representation. Eq.(2) can, therefore, be rewritten as:

$$y_t = \mathbf{Z}'\beta_t + \mu_t \qquad \textit{(measurement equation)} \qquad (2')$$

$$\beta_t = F\beta_{t-1} + \eta_t \qquad \textit{(transition equation)} \qquad (3)$$

As said before y_t is the value of output gap, while $\mathbf{Z}$ is now a matrix of dimension *(Txk)* which includes all the explanatory variables plus a constant; the state vector β_t, a (*kx1*) vector that contains all the slope coefficients, which are now varying through time. The F matrix, of dimension (*kxk*), contains the autoregressive coefficients of β_t. We allow the coefficient β_t to follow a random walk process. The error terms are assumed to be independent white noise $Var(\mu_t) = Q$; $Var(\eta_s) = R$; $Var(\mu_t\eta_s) = 0$ for all *t* and *s*.

Such a representation can, then, be used to compute the estimates of a state vector for t = k + 1; k + 2; :::; T using the Kalman filter. For the purpose of our analysis, this algorithm is valuable because it allows us to recover the dynamic of the iteration between the economic activity gap and its explanatory variables. Furthermore this econometric technique has the strength to be valid even when we suspect structural change during the estimation period but are unsure as to when breaks might occur. This recursive algorithm, in fact, computes the linear lest square of the forecasted state vector given data observed at time t. Given starting values of the state coefficient estimated by the OLS, it recursively updates each period's coefficient conditional on past information so that to maximize the likelihood function until the convergence is reached. The state vector β_t and its mean squared error $P = E\left[(\beta_t - \hat{\beta}_t)(\beta_t - \hat{\beta}_t)'\right]$ are recursively estimated by:

$$\beta_{t|t} = F\beta_{t|t-1} + H_{t-1}Z(Z'H_{t-1}Z + Q)^{-1}(y_{-1} - Z'F\beta_{t-1|t-1})$$

and

$$P_{t|t} = H_{t-1} - H_{t-1}Z(Z'H_{t-1}Z + Q)^{-1} ZH_{t-1}$$

Where: $H_{t-1} = FP_{t-1|k-1}F' + R$, and $\beta_{t+1|t}$ is the forecast of the state vector at time period t+1, given information available at time t[10].

The methodology presented above allows us to recover an unobservable factor that could affect the output gap. For each endogenous variables of the model it is therefore possible to observe how the respective coefficients have changed over time by the effect of changing in the weights attached to each single asset price.

The second step consists of calculating the weights of each single asset of the FCIs, as defined above, in the following way:

$$weight\ of\ X_{i,t} = \frac{coefficient\ value\ of\ X_{i,t}}{\sum_{t=1}^{n} coefficient\ value\ of\ all\ assets} = W_{i,t} \qquad (4)$$

where $X_{i,t}$ is the price of asset i in period t and n is the sample size. The time varying weights are presented in the appendix 1, figures 1 to 4.

The final step concerns the definition of the FCI:

$$FCI_t = \sum_{t=1}^{n} (W_{i,t})(ri_t + re_t + rh_t + rs_t) \qquad (5)$$

Figure 5 shows the FCI for the four countries. The FCIs present different ranges. The USFCI is the most volatile (-10; +8.2) and fluctuate around the value of (–1) during the period. The volatility for the US increases in the period 2000-2003. The CAFCI that fluctuate around zero within a range of (-2.4; +3.6). Finally, the EUFCI shows

[10] Harvey (1989)

quite a strong volatility compared to the CA FCIs but is almost similar to the USFCI. The range is within the band of (–8.3;+7.6) and fluctuate around the value of (–1)[11].

4. FCI and Forward-looking Taylor Rules

In this section we provide the estimates of standard forward-looking interest rate rules and of rules which allow for Financial Condition Index to be a target and an information variable for the Central Bank.

4.1 Benchmark Taylor Rule: specification and estimation

Following Clarida *et al.* (1998) we assume that the Central Bank has an operating target for the nominal short term interest rate that is based upon the state of the economy. Our benchmark model is the standard Taylor rule, where interest rate is set according to the evolution of the output gap and expected inflation. In each period, the actual interest rate partially adjusts towards the target value. Svensson (1997) justifies the partial adjustment mechanism by including the change in interest rates in the Central Bank's loss function. Combining the target rule with the partial adjustment mechanism we obtain the empirical form of the monetary policy reaction function:

$$R_t = \left(1 - \sum_{i=1}^{l} \varphi_i\right)\left\{a + \beta(E_t[\pi_{t+n}] - \pi^*) + \gamma E_{t-1}[\tilde{y}_t]\right\} + \sum_{i=1}^{l} \varphi_i R_{t-i} + u_t \qquad (6)$$

where $\sum_{i=1}^{l} \varphi_i \in [0,1]$ measuring the degree of interest rate smoothing, π^* is the inflation target (implicit or explicit), and $\alpha = r^* - \beta\pi^*$, with r^* denoting the long-run equilibrium nominal interest rate. Due to the fact that monetary policymakers cannot observe $\tilde{y}_t$ when setting R_t, we replace the actual value of the output gap with its

[11] It is important to note that, due to the lack of montly data availability, the EUFCI is constructed using only three of the four assets. In particular, we construct the EUFCI considering the real interest rate, the real exchange rate and the real stock price.

expected level, $E_{t-1}[\tilde{y}_t]$[12]; The error term, u_t, represents a white noise monetary policy shock. We consider an inflation forecast horizon of one year, therefore we set n equal to 12 in our estimation.

In order to estimate the model, unknown expected future variables are replaced with their ex-post realized values. This leads us to Equation 4:

$$R_t = \left(1 - \sum_{i=1}^{l} \varphi_i\right)\left\{a + \beta(\pi_{t+n} - \pi^*) + \gamma \tilde{y}_t\right\} + \sum_{i=1}^{l} \varphi_i R_{t-i} + \omega_t \tag{7}$$

The set of orthogonality conditions implied by Equation (7) is:

$$E_t\left[R_t - \left(1 - \sum_{i=1}^{l} \varphi_i\right)\left\{a + \beta(\pi_{t+n} - \pi^*) + \gamma \tilde{y}_t\right\} + \sum_{i=1}^{l} \varphi_i R_{t-i} \middle| I_t\right] = 0 \tag{8}$$

where I_t represents all the variables in the Central Bank's information set available at time t when the interest rate is chosen. I_t is a vector of variables that are orthogonal to ω_t. These instruments are lagged variables that help forecasting inflation and output, and contemporaneous variables that are uncorrelated with the exogenous monetary policy shock, u_t. The benchmark reaction function given by Equation (7) is estimated using the Generalised Method of Moments (GMM). The instruments employed in the estimation include a constant and six lags of the nominal short-term interest rate, inflation, output gap, and a world commodity price index (agricultural raw materials). Since the number of instruments is greater than the number of elements of the parameter vector [φ_i, α, β, γ], we test for the validity of the over-identifying restrictions using the Hansen (1982) *J*-statistic. As pointed out by Clarida *et al.* (1998), failure to reject orthogonality implies that the Central Bank considers lagged variables in its reaction function, only to the extent that they forecast future inflation or output.

[12] See see McCallum and Nelson, 1999, and Orphanides, 2000 for a further discussion of the uncertainties faced by the policymaker with respect to output.

The GMM estimation results in Tables 1 to 3, column 2, indicate that the benchmark specification satisfies the dynamic stability criterion since the estimated inflation coefficient, β, is greater than one[13] The output gap coefficient, γ, is positive and statistically significant at the 1 % level in all the estimates. The sum of the interest rate smoothing parameters is close to one for all the four Central Banks under consideration, indicating a high level of persistence in short term interest rates. Finally, the *J*-statistic indicates that the over-identifying restrictions of the benchmark model are not rejected.

4.2 Interest rate and FCI

As pointed out in the previous section, asset prices contain important information about future aggregate demand and consequently inflation pressures. Also, there are theoretical arguments in favour of including asset price inflation in the reaction function of the Central Bank. Cecchetti *et al.* (2000) find that, on the basis of simulations, it would be desirable to include asset inflation in the Taylor rule. Augmented Taylor rules are usually estimated including each single variable independently in the model without any consideration for the importance of that particular market in that particular time. However, as reported in many data reported[14] the composition of households and firms total assets changes over time and this is likely to be considered when monetary policy set the interest rate. The Financial Condition Index calculated in the previous section should overcome this issue, since it is a weighted index. Thus, we proceed by considering alternatives to our benchmark specification, by allowing asset prices to enter in the Taylor rule. The augmented reaction functions we consider are of the form[15]:

$$R_t = \left(1 - \sum_{i=1}^{l} \varphi_i\right)\left\{a + \beta(E_t[\pi_{t+n}] - \pi^*) + \gamma E_{t-1}[\tilde{y}_t] + \omega\chi_{t-n}\right\} + \sum_{i=1}^{l} \varphi_i R_{t-i} + \varepsilon_t \qquad (9)$$

[13] If β was smaller than the stability threshold of one, then this would imply a positively sloped aggregated demand, with output decreasing in response to an inflation shock (Taylor, 1998).
[14] See OECD Economic Outlook.
[15] See Kontonikas and Montagnoli (2003) for a theoretical derivation of Eq. (9).

where x_{t-n} denotes the relevant financial condition index and ω the relevant coefficient. We assume that n is equal to zero We use contemporaneous, and not expected, Financial Condition Index due to the well known difficulties involved in forecasting asset price movements. Also, the weak form efficiency implies that the current asset price reflects all past history, thus there is no need to incorporate lags. This implies that at every disequilibria at time t, Central Banks intervene at time t+1 when $\omega > 0$.

In all three cases we have a positive and statistically significant value of the inclusion of contemporary Financial Condition Index[16]. Looking at the descriptive statistics of actual and estimated interest rates (Tables 4-6), we see that the inclusion of the FCI is superior, although marginally, to a benchmark Taylor Rule specification. Interpreting these results is not an easy task; Central Banks always stress that they do not have any other objective than to keep the level of inflation within the target –when it exists- or at a level that is compatible with the overall economic outlook, therefore a positive FCI does not have an immediate interpretations. We can suggest two alternative explanations: firstly asset markets might have a role in interest rate setting because they contain information about the future level of asset prices and output particularly when they diverge from their fundamental value. Second, if we accept that Central Banks do not only have the objective of monetary stability but also of financial stability, then asset prices can play an important role in monetary policy. In a context characterized by asymmetric information, financial markets determine the value of the collateral, hence, fixing the cost of capital; in other words they delimit the amount of capital firms are able to borrow. In such an environment, an increase in the Bank's interest rate has a more than proportional impact on the cost of capital. Given this, monetary policy should always consider the level of the business cycles and the level of indebtedness; failing to do so might cause financial instability in the system.

5. Conclusions

[16] We checked whether having t-n lags in the FCI suggested by Bernake and Gertler (1999) and Chadha *et al.* (2003) made a difference. Overall the inclusion of lags do not qualitatively and quantitatively improve our estimate.

Starting from the seminal work of Alchian and Klein (1973) it is often argued that the forward-looking nature of asset prices makes them good proxies for the information left out of conventional inflation measures. It is also widely accepted that asset price inflation developments are closely associated with general inflation trends. This paper investigated the role of asset prices in the conduct of monetary policy in the United States, Canada and the Euro Area. We constructed Financial Condition Indexes for the four countries using the Kalman Filter algorithm. This methodology allowed us to capture the changes of the weights over time. Second, we proceeded by estimating forward-looking Taylor rules augmented for FCI. The results from the Taylor rules suggest that the Financial Condition Index enter positively and statistically significant into the FED, ECB and Bank of Canada interest rate setting. This gives a positive view for the use of the FCI as an important short term indicator to guide the conduct of monetary policy in the three countries analyzed.

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Appendix 1

Figure 1 US weights of the single asset for the FCI

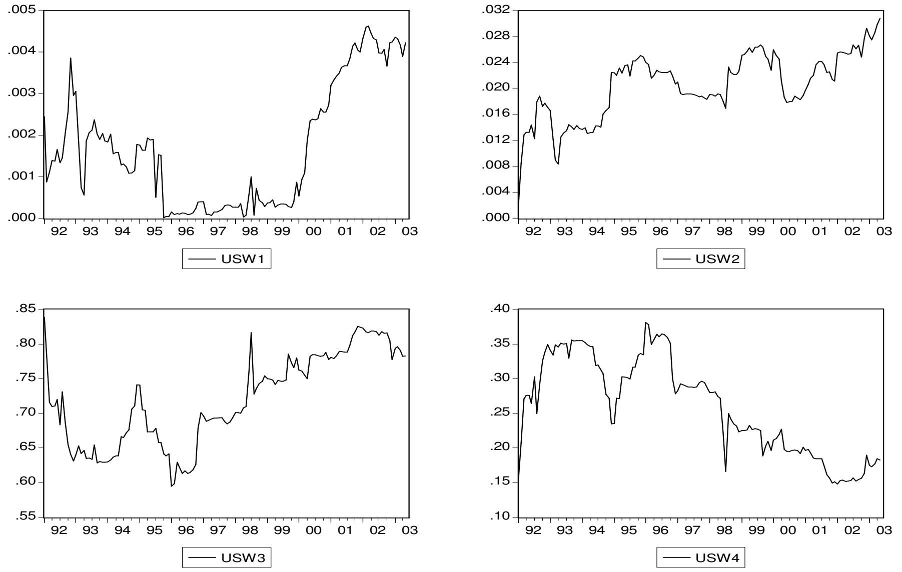


Figure 2 Canada weights of the single asset for the FCI

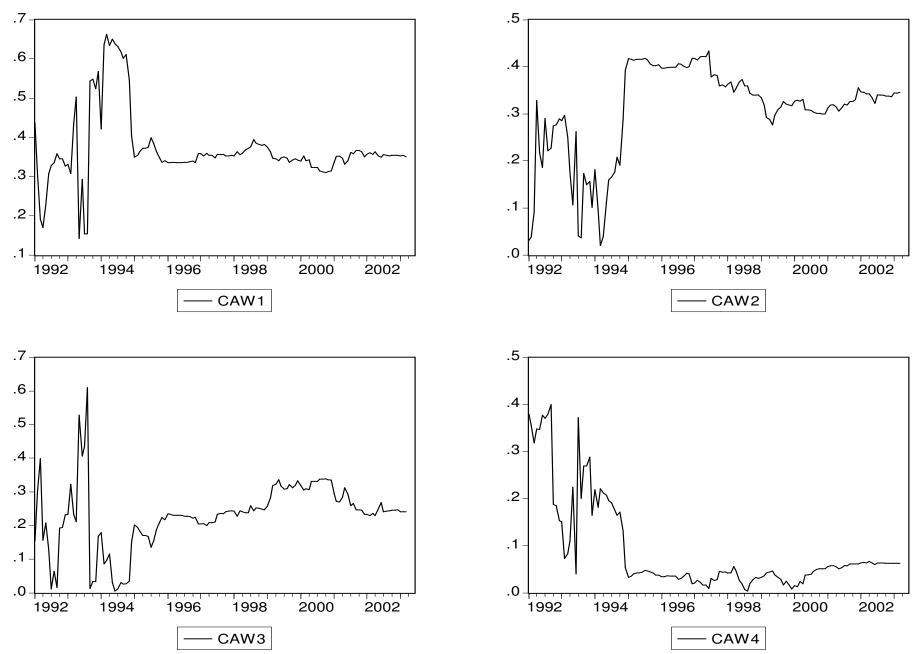


Figure 3 EU weights of the single asset for the FCI

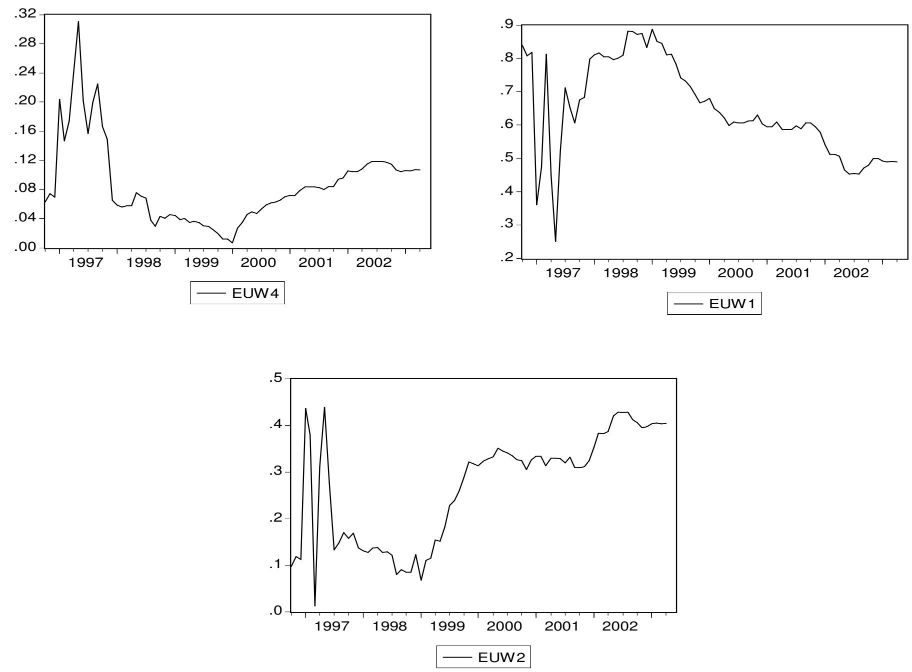
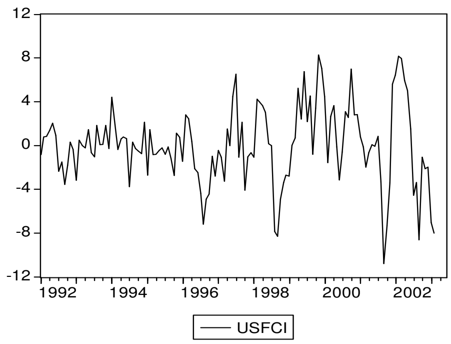
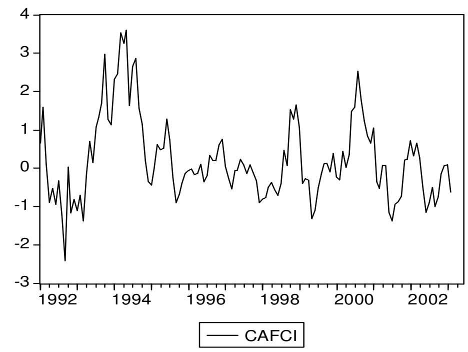
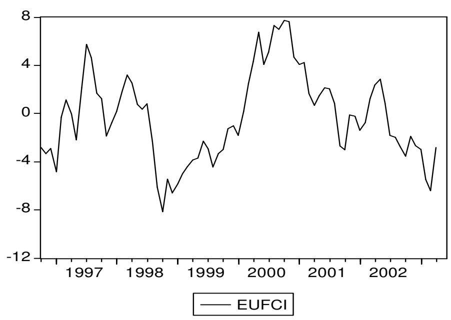


Figure 5 FCIs







Appendix 2

Table 1: GMM Estimates of US Forward Looking Taylor Rule, 1994:01-2003:2

	a	β	γ	$\sum_{i=1}^{l}\varphi_i$	$X_t = [\pi_t^{FCI}]'$	J- Stat.
Benchmark Model	1.95***	2.740***	0.67***	0.890***	---	0.099
Augmented Model 1	4.950***	2.059**	0.370***	0.943**	0.265***	0.071

Note:

1. Estimates are obtained by GMM estimation with correction for MA(12) autocorrelation. Two-stage least squares estimation is employed to obtain the initial estimates of the optimal weighting matrix.
2. In the benchmark model the instruments used are a constant and lags 1 to 6 of the nominal short term interest rate, inflation, output gap, and a world commodity price index (agricultural raw materials). In the model that includes asset price inflation, lags 1 to 6 of the constructed FCI is also included.
3. *J*-stat denotes the test statistic for overidentifying restrictions.
4. *, **, *** indicate level of significance of 10%, 5%, and 1% respectively.

Table 2: GMM Estimates of EU Forward Looking Taylor Rule, 1998:01-2003:2

	a	β	γ	$\sum_{i=1}^{l}\varphi_i$	$X_t = [\pi_t^{FCI}]'$	J- Stat.
Benchmark Model	3.769***	4.430***	0.818***	0.829***	---	0.123
Augmented Model 1	3.620***	3.802***	0.646***	0.800***	0.112***	0.208

Note: See Table 1.

Table 3 GMM Estimates of Canada Forward Looking Taylor Rule, 1994:01-2003:2

	a	β	γ	$\sum_{i=1}^{l}\varphi_i$	$X_t = [\pi_t^{FCI}]'$	J- Stat.
Benchmark Model	1.921	3.307***	1.233***	0.946**	---	0.142
Augmented Model 1	2.775**	1.533***	0.791***	0.955***	0.1521***	0.206

Note: See Table 1

Table 4. Canada Descriptive Statistics of Actual and Taylor Rules Target Interest Rate

	Actual Interest Rate	*Taylor Rule*	*Augmented Taylor Rule*
Mean	4.699	4.582	4.660
Median	4.75	4.625	4.658
S. Dev.	1.367	1.327	1.365
Kurtosis	0.110	-0.326	0.086
Skewness	0.163	0.150	0.251
Minimum	1.97	2.281	2.048
Maximum	8.22	7.897	8.219

Table 5. EMU Descriptive Statistics of Actual and Taylor Rules Target Interest Rate

	Actual Interest Rate	*Taylor Rule*	*Augmented Taylor Rule*
Mean	3.824	3.887	3.838
Median	3.755	3.765	3.747
S. Dev.	0.704	0.756	0.712
Kurtosis	-0.967	-0.920	-0.956
Skewness	0.031	0.169	0.220
Minimum	2.58	2.607	2.680
Maximum	5.09	5.359	5.204

Table 6. US Descriptive Statistics of Actual and Taylor Rules Target Interest Rate

	Actual Interest Rate	*Taylor Rule*	*Augmented Taylor Rule*
Mean	4.567	4.669	4.559
Median	4.99	4.961	4.944
S. Dev.	1.186	1.189	1.119
Kurtosis	-0.219	0.041	-0.024
Skewness	-0.775	-0.690	-0.787
Minimum	1.69	1.571	1.723
Maximum	6.38	6.715	6.323

Appendix 3

Country	Interest Rate	Exchange Rate	CPI	House Price	Output	Stock price
USA	US TREASURY BILL RATE - 3 MONTH	US REAL EFFECTIVE EXCHANGE RATE INDEX - CPI BASED	US CPI - ALL URBAN SAMPLE ALL ITEMS	US AVERAGE PRICE OF HOUSE SOLD*	US INDUSTRIAL PRODUCTION - TOTAL INDEX	US DOW JONES INDUSTRIALS SHARE PRICE INDEX
EUM	RT.MM.EUR. EURIBOR.3 MONTH	EU REAL EFFECTIVE EXCHANGE RATE INDEX - CPI BASED	HICP - OVERALL INDEX EURO AREA	NA	EU INDUSTRIAL PRODUCTION - TOTAL INDEX	EM SHARE PRICE INDEX
Canada	CN TREASURY BILL RATE - 3 MONTH	CN REAL EFFECTIVE EXCHANGE RATE INDEX - CPI BASED	CN CPI	CN HOUSING PRICE INDEX	CN INDUSTRIAL PRODUCTION - TOTAL INDEX	CN TORONTO STOCK EXCHANGE COMPOSITE SHARE PRICE INDEX

Source: All data are from the IMF-Financial Statistics collected by DATASTREAM
*** Source: National Association of Home Builders**
NA = Not Available