FCIs and Economic Activity :
Some International Evidence*

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ABSTRACT

A Monetary Conditions Index (MCI), a weighted average of the short-term real interest rate and the real exchange rate, is a commonly used indicator of aggregate demand conditions. In-sample evidence for the US, the euro area, Japan and the UK suggests that a Financial Conditions Index (FCI), also comprising property prices and share prices, would be a better indicator for economic activity than the standard MCI. Out-of sample the FCI also performs better than the MCI, but its overall performance is mixed. An FCI would have predicted the recent economic downturn in Japan and the UK, but not in the US and the euro area.

* We thank Ben Bernanke, Andrew Filardo, Jürgen von Hagen, Frank Smets, Bernd Hayo and participants at the the Stanford University/San Francisco Fed Conference on '*Asset Prices, Exchange Rates, and Monetary Policy*', 2-3 March 2001 and seminars at the ZEI for helpful comments and suggestions.
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1. Introduction

A Monetary Conditions Index (MCI), a weighted average of the short-term interest rate and the exchange rate, has commonly been used as a composite measure of the stance of monetary policy. The MCI concept was pioneered by the Bank of Canada in the 1980s (Freedman, 1995, Duguay, 1994), based on empirical findings that inflationary pressures are determined by excess aggregate demand and that monetary policy mainly affects aggregate demand via its leverage over short-term interest rates and the real exchange rate. In the underlying class of models on which the MCI concept is based, the short-term real interest rate and the real exchange rate are the main determinants of aggregate demand. The interest rate determines internal demand conditions via its effect on the cost of borrowing and the returns to saving, while the exchange rate determines external demand via the relative price of tradable goods[1].

Recent developments in theoretical and empirical research on the monetary transmission process suggest that property and equity prices may also play an important role in the transmission of monetary policy via wealth and balance sheet effects. Monetary policy can affect property and equity prices via arbitrage effects and the expected value of future dividends. Changes in asset prices affect economic activity via wealth and balance sheet effects. A change in property and equity prices may affect consumers' perceived lifetime wealth, inducing them to change their consumption plans[2]. Another, more indirect wealth effect of property and equity price movements operates via households' and firms' balance-sheets. Households and firms may be borrowing constrained due to asymmetric information in the credit market, which gives rise to adverse selection and moral hazard problems[3]. As a

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[1] Formal treatments of the theoretical underpinnings of the MCI concept can be found in Ball (1998), Gerlach and Smets (2000), and Svensson (2000).
[2] See Modigliani (1971).
[3] Basic references of this literature are Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). For a survey see Bernanke et al. (1998).

result, households and firms can only borrow when they offer collateral, so that their borrowing capacity is a function of their net worth, which in turn depends on asset valuations[4].

Thus, there are good reasons to consider other potential determinants of aggregate demand variables besides the real interest rate and the real exchange rate. This implies that an extended MCI, a Financial Conditions Index (FCI), comprising a wider set of asset prices and yields, may be a more useful indicator of aggregate demand conditions than the standard MCI[5]. However, while there is a large empirical literature on MCIs, there are only very few studies trying to estimate an FCI empirically[6]. In the following we construct MCIs and FCIs for the four largest economic areas of the world, the US, the euro area, Japan and the UK, using quarterly data over the period 1982-1997. The indices are derived based on coefficient estimates from reduced form aggregate demand equations. The results suggest that that the real interest rate and real property prices are important determinants of aggregate demand conditions, while the exchange rate and share prices are generally not found to have a significant effect on output. In-sample, FCIs appear to have been better indicators for the development of economic activity than the standard MCIs. Out-of sample the FCI also performs better than the MCI, but its overall performance is mixed. An FCI would have predicted the recent downturn in economic activity in Japan and the UK, but not in the US and the euro area.

The plan of the paper is as follows. In section 2 we discuss potential strategies and problems associated with the construction of an FCI. In section 3 we estimate reduced form aggregate demand equations. Based on these estimates we derive in Section 4 MCIs and FCIs and evaluate their performance as indicators of economic activity. Section 5 concludes.

[4] On the empirical relationship between bank lending and asset prices see Borio et al. (1994), IMF (2000), BIS (2001) and Hofmann (2001).
[5] Smets (1997) generalizes the theoretical analysis of Gerlach and Smets (2000) and develops a theoretical foundation of an FCI.
[6] The exception are Mayes and Virén (2001) who estimate an FCI comprising a real short-term interest rate, the real exchange rate and the change in real house and share prices for the euro area.

2. Constructing Monetary and Financial Conditions Indices: Conceptual Issues

FCIs can be estimated based on:

- simulations in large scale macro-econometric models
- VAR impulse responses
- reduced form aggregate demand equations.

Large-scale macro-econometric models are developed by central banks, international organisations and economic research centers to analyse the effects of economic policy measures and all kinds of shocks. Mayes and Virén (2000) use the National Institute Global Economic Model (NIGEM) to simulate interest rate and exchange rate shocks in order to derive MCIs for euro area countries[7]. However, neither the NIGEM nor any other multi-country macroeconometric model incorporates housing prices, so that large scale macroeconometric models are not an option for the derivation of FCIs.

Vector Autoregressive Models (VARs) are commonly used to analyse the dynamic effects of monetary policy shocks[8]. FCI weights could also be derived based on the impulse responses of output to asset price shocks in an identified VAR. The major short-coming of such a VAR based approach is that the practical meaning of the identified asset price shocks would not be clear[9]. FCI weights derived based on VAR analysis apply to asset price and interest rate shocks and cannot be generalised to systematic asset price and interest rate movements. Also, the VAR impulse responses will depend on the identifying restrictions imposed on the system, for which we do not have clear theoretical priors.

[7] For an alternative set of MCI estimates for the euro area based on the Nederlandsche Bank's EUROMON model see Peeters (1998).
[8] See Sims (1980) as the basic reference and Bagliano and Favero (1997) for a more recent review of the issues.
[9] The same criticism has been brought forward against the analysis of monetary policy shocks in a VAR (Rudebusch, 1998)

The most commonly used approach to derive MCI weights is to estimate reduced form aggregate demand equations. This approach can also be easily applied to derive FCI weights (Mayes and Virén, 2001). However, when estimating FCI weights using reduced form demand equations, there are several caveats which we want to address beforehand[10]. First, if a reduced form model is not stable over sub-samples and if the MCI/FCI weights have wide confidence bands, then the estimated MCIs and FCIs become unreliable. Thus, when estimating an FCI, the assessment of statistical significance should receive sufficient attention.

The reliability of an MCI or FCI is also impeded if the weights are model dependent. There are various possible specifications for reduced form aggregate demand equations. In his classical MCI paper, Duguay (1994) derives MCI weights for Canada based on an output growth equation. For the euro area, Mayes and Viren (2000) estimate MCIs for euro area countries by regressing the output gap on the level of the real interest rate and the level of the real exchange rate, while Dornbusch et al. (1998) take real GDP growth as the dependent variable. Batini and Turnbull (2000) estimate an output gap regression equation to derive MCI weights for the UK. Ericsson et al. (1998) derive MCI weights for Canada, New Zealand, Norway, Sweden and the US based on output growth regressions.

Reduced form regressions are exposed to the Lucas critique with particular force. Changes in policy regime and economic structure may give rise to instability in the estimated relationships. As a result, significant in sample evidence may be a poor guide for out of sample prediction. Since FCIs are supposed to be indicators of future demand conditions, this argument is of particular relevance in the following analysis. Any in sample based derivation of MCIs and FCIs should therefore be complemented with an assessment of their out of sample forecasting performance.

Simple backward-looking IS Curves regressions may also not be able to disentangle the demand effects of interest rates and asset prices from their endogenous forward looking

[10] For a discussion of the caveats associated with estimating and interpreting an MCI see Eika et al. (1996), Ericsson et al. (1998) and Gerlach and Smets (2000).

component. For equity and property prices, the bias that may arise from this simultaneity will be upwards. According to standard asset pricing theory, asset prices are equal to the discounted sum of future returns. If future returns are positively correlated with future output, anticipation of higher future output would lead to a rise in asset prices. Thus, a positive correlation between output and lagged share and property prices may arise because of either demand effects or because of forward-looking expectations in asset markets. As a result, estimated demand effects of asset prices may be upwards biased.

For interest rates and exchange rates, on the other hand, the bias will be rather downwards. If monetary policy is forward looking, then the endogenous component of monetary policy will be positively correlated with future output. As a result, the estimated negative demand effect of interest rate changes may be biased downwards. A depreciation of the effective real exchange rate will stimulate external demand and thus have a positive effect on aggregate demand. It may, however, also reflect expectations about a weaker economy in the future, associated with lower returns on domestic assets relative to foreign assets. As a result, the demand effect of exchange rate movements may also be biased downwards.

3. Asset Prices and Economic Activity

In the following we estimate MCIs and FCIs for the four major economic areas of the world, the US, the euro area, Japan and the UK. Given the short-comings of the other two alternative approaches and following the empirical literature on MCIs we will base our analysis on reduced form aggregate demand equations, bearing in mind that there is also a large range of problems associated with this approach, as we discussed in the previous section. The estimating equations are of the form:

MCI Model:

(1) $y_{t+1} = \beta_1(L)y_t + \beta_2(L)rir_t + \beta_3(L)rex_t + \varepsilon_t$,

FCI Model:

$$(2)\quad y_{t+1} = \beta_1(L)y_t + \beta_2(L)rir_t + \beta_3(L)rex_t + \beta_4(L)ir_t + \beta_5(L)\Delta rhp_t + \beta_6(L)\Delta rsp_t + \eta_t .$$

In order to assess the robustness of our results with respect to the chosen measure of economic activity (*y*), we estimate the models both for the output gap, measured as the percent gap between real GDP and potential real GDP, where potential real GDP is calculated using a standard Hodrick-Prescott-Filter with a smoothing parameter of 1600, and for the quarterly change in real GDP as the dependent variable. *rir* is the short-term ex-post real interest rate, calculated is the differences between the short-term nominal interest rate and the quarterly CPI inflation rate. *rex* is the effective real exchange rate defined as units of home currency per unit of foreign currency, so that a higher real effective exchange rate is a real depreciation. Δrhp and Δrsp are respectively the change in real residential property prices and real share prices. Real house price and share price indices were calculated by deflating the nominal house and share price indices with the CPI.

Data on real GDP, consumer prices, interest rates and share prices were taken from the IMF International Financial Statistics for the US, Japan and the UK. Aggregate euro area data were provided by the ECB. Real effective exchange rates were taken from the OECD Main Economic Indicators. Residential property price data for the US, the euro area, Japan and the UK originate respectively from the US Office of Federal Housing Enterprise Oversight (OFHEO), the ECB, the Japan Real Estate Institute and the UK Department of the Environment.

Empirical measures of the long-term real interest rate appeared to be highly correlated with the short-term real interest rate, introducing a severe multicollinearity problem in the estimation and often giving rise to implausible coefficient estimates[11]. For this reason we do

[11] This finding may be due to measurement problems. Aggregate demand depends on the ex-ante real long-term interest rate, defined as the difference between the long-term nominal interest rate and long-term inflation expectations. There is no direct measure of the ex-ante real long-term interest rate available across countries, so

not consider the long-term real interest rate as a separate determinant of aggregate demand. Given the high correlation between the two real interest rate measures, the short-term real interest rate will capture the demand effects of both the short-term and long-term real interest rate.

The equations were estimated by OLS over the sample period 1982:1-1998:4[12]. The final specification was chosen by a general-to-specific modelling strategy, retaining all lags of a variable between the first and last lag significant at the 10% level, searching over up to five lags. If no lag was significant at least at the 10% level, the lag with the highest t-statistic was retained.

Tables 1 and 2 report the estimation results for the MCI model. *Lags* reports the lags retained for each variable. If more than one lag was retained we report the sum of the coefficients of the retained lags. Standard errors are in parentheses, elasticities which are significant at least at the 10% level are in bold. The results suggest that the MCI model yields very poor estimates of the demand effects of the real exchange rate. Neither the output gap nor the output growth regressions yield a single significant exchange rate elasticity. The real interest rate elasticities are significant in the US, the euro area and Japan, but insignificant in the UK[13].

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that for empirical studies an ex-post long-term real interest rate, defined as the difference between the long-term nominal interest rate and the current level or a moving average of the inflation rate, is usually used. Batini and Turnbull (2001) find a significantly negative effect of the real yield of an indexed linked long-term bond on the output gap in the UK. Indexed linked long-term bonds are indeed likely to be a better proxy for the ex-ante long-term real interest rate than ex-post measures, but have been issued only in the UK for a period sufficiently long for time series regression analysis.

[12] The sample period was chosen in order to avoid that the large increase in short-term real interest rates in the early 1980s dominates the estimation results.

[13] Nelson (2001, 2002) also finds an insignificant real interest rate elasticity for the UK and refers to this finding as the IS Puzzle.

Table 1: OLS estimates of MCI model; Dependent variable: output gap

Country *(Lags)*	*rir*	*rex*	$\overline{R}^2$ *DW*
USA (1-2,3,1)	**-0.085** **(0.041)**	-0.015 (0.009)	0.88 2.32
Japan (1,1,1)	**-0.158** **(0.037)**	0.003 (0.003)	0.79 2.25
EU (1,2,2)	**-0.098** **(0.044)**	0.001 (0.008)	0.73 1.96
UK (1-2,4,3)	-0.021 (0.026)	0.015 (0.009)	0.88 1.95

Note: rir is the ex-post short-term real rate of interest and rex is the effective real exchange rate. 'Lags' indicates the lags retained of each variable. The table shows the coefficient sum of the retained lags with standard errors in parentheses. Significant elasticities are in bold.

Table 2: OLS estimates of MCI model; Dependent variable: output growth

	rir	*rex*	$\overline{R}^2$ *DW*
USA (1-5,3,1)	**-0.317** **(0.182)**	-0.093 (0.041)	0.42 2.11
Japan (1-3,1,1)	**-0.42** **(0.175)**	0.011 (0.013)	0.53 2.15
EU (1-4,2,1)	**-0.503** **(0.194)**	0.009 (0.035)	0.23 1.85
UK (1-3,4,1)	-0.028 (0.113)	0.058 (0.045)	0.3 1.96

Note: rir is the ex-post short-term real rate of interest and rex is the effective real exchange rate. 'Lags' indicates the lags retained of each variable. The table shows the coefficient sum of the retained lags with standard errors in parentheses. Significant elasticities are in bold.

Tables 3 and 4 report the estimation results for the FCI model. The demand effects of the real interest rate and of the change in real property prices appear to be well identified. In each case we find a significantly negative effect of the real interest rate and a significantly positive effect of the change in real property prices on the output gap and on output growth. The demand effect of the real exchange rate is still poorly identified. Only for the euro area do we find an exchange rate elasticity which is significant at the 1% level. In all other case the exchange rate elasticity is not significantly different from zero. The change in real equity prices appears to be unrelated to the output gap, but is found to have a significantly positive effect on output growth in Japan and the UK.

Table 3: OLS estimates of FCI model; Dependent variable: output gap

	rir	*rex*	Δrhp	Δrsp	$\overline{R}^2$ *DW*
USA (1-2,3,1,1,3)	**-0.079 (0.039)**	-0.01 (0.009)	**0.047 (0.019)**	0.005 (0.003)	0.90 2.22
Japan (1,1,1,1,4-5)	**-0.185 (0.036)**	0.002 (0.003)	**0.041 (0.017)**	-0.0002 (0.003)	0.83 2.39
Euro Area (1,2,2,3,1)	**-0.091 (0.039)**	**0.031 (0.009)**	**0.054 (0.012)**	-0.002 (0.002)	0.80 1.92
UK (1-2,4,3,2,4)	**-0.042 (0.025)**	0.012 (0.009)	**0.02 (0.006)**	0.002 (0.002)	0.91 2.1

Note: rir is the ex-post short-term real rate of interest, rex is the effective real exchange rate, Δrhp *is the change in real property prices and* Δrsp *is the change in real share prices.'Lags' indicates the lags retained of each variable. The table shows the coefficient sum of the retained lags with standard errors in parentheses. Significant elasticities are in bold.*

Table 4: OLS estimates of FCI model; Dependent variable: output growth

	rir	*rex*	Δrhp	Δrsp	$\overline{R}^2$ *DW*
USA (1-4,3,1-4,1,3)	**-0.346 (0.174)**	-0.062 (0.041)	**0.29 (0.094)**	0.019 (0.012)	0.53 2.07
Japan (1,1,1,3-5)	**-0.575 (0.147)**	0.011 (0.011)	**0.245 (0.07)**	**0.03 (0.014)**	0.66 (2.34)
Euro Area (1-4,2,1,3,2)	**-0.538 (0.179)**	**0.10 (0.05)**	**0.21 (0.068)**	0.013 (0.009)	0.39 1.72
UK (1-2,4,2,2,2-5)	**-0.21 (0.111)**	0.053 (0.042)	**0.098 (0.027)**	**0.074 (0.025)**	0.45 1.94

Note: rir is the ex-post short-term real rate of interest, rex is the effective real exchange rate, Δrhp *is the change in real property prices and* Δrsp *is the change in real share prices.'Lags' indicates the lags retained of each variable. The table shows the coefficient sum of the retained lags with standard errors in parentheses. Significant elasticities are in bold.*

In Table 5 we summarise the estimation results by reporting for each explanatory variable the number of significant elasticities obtained from each of the estimated equations. The numbers show that we obtain many more significant elasticities from the FCI equations than from the MCI equations, suggesting that the FCI model does a much better job in explaining the development of economic activity.

Table 5: The performance of the empirical models

MCI model				FCI model							
rir		*rex*		*rir*		*rex*		Δrhp		Δrsp	
gap	Δgdp	*gap*	Δgdp	*gap*	Δgdp	*gap*	Δgdp	*gap*	Δgdp	*gap*	Δgdp
3	3	0	0	4	4	1	1	4	4	0	2

Note: The table displays the number of significant elasticities obtained for each explanatory variable.

4. MCIs, FCIs and the recent downturn in economic activity

Based on the estimated elasticities in the IS equation we can now derive weights for the MCIs and FCIs. MCIs and FCIs are calculated as $\sum_i w_i \left(q_{it} - \overline{q}_i\right)$, where q_{it} is the realisation of variable i in period t, $\overline{q}_i$ is the realisation of the FCI in a base period and w_i is the relative weight given to variable i in the FCI. We calculate the weight of variable i by dividing the sum of the absolute value of the estimated coefficient of variable i by the sum of the absolute value of the estimated coefficients of all variables included in the FCI.

The resulting MCI and FCI weights are displayed in Tables 6 and 7 respectively. Standard errors of the weights are in parentheses. Except for the UK, the MCI weights are broadly similar across the two empirical models, suggesting that the choice of the measure of economic activity does not have a strong effect on the derived weights. The exchange rate does not appear to play an important role in the MCIs. The weight of the exchange rate is insignificant in the euro area, Japan and the UK. In the US the weight is significant but results from an implausible negative exchange rate elasticity (see Table 1).

Table 6: MCI Weights

	Output Gap Model		GDP Growth Model	
	rir	*rex*	*rir*	*rex*
USA	0.85 (0.05)	0.15 (0.05)	0.77 (0.06)	0.23 (0.06)
Japan	0.98 (0.02)	0.02 (0.02)	0.97 (0.03)	0.03 (0.03)
Euro Area	0.99 (0.08)	0.01 (0.08)	0.98 (0.07)	0.02 (0.07)
UK	0.58 (0.35)	0.42 (0.35)	0.32 (0.92)	0.68 (0.92)

Note: rir is the ex-post short-term real rate of interest, rex is the effective real exchange rate. MCI weights are calculated by dividing the sum of the absolute value of the estimated coefficient of a variable by the sum of the absolute value of the estimated coefficients of all variables included in the MCI. Standard errors are in parentheses.

Table 7: FCI Weights

	Output Gap Model				GDP Growth Model			
	rir	*rex*	Δrhp	Δrsp	*rir*	*rex*	Δrhp	Δrsp
USA	0.56 (0.13)	0.07 (0.05)	0.33 (0.16)	0.04 (0.02)	0.48 (0.12)	0.09 (0.04)	0.40 (0.15)	0.03 (0.02)
Japan	0.81 (0.06)	0.01 (0.01)	0.18 (0.06)	0.00 (0.01)	0.67 (0.06)	0.01 (0.01)	0.29 (0.06)	0.03 (0.02)
Euro Area	0.51 (0.13)	0.17 (0.06)	0.31 (0.08)	0.01 (0.01)	0.63 (0.11)	0.12 (0.05)	0.24 (0.06)	0.01 (0.01)
UK	0.56 (0.16)	0.15 (0.12)	0.26 (0.1)	0.03 (0.03)	0.48 (0.14)	0.12 (0.1)	0.23 (0.07)	0.17 (0.06)

Note: rir is the ex-post short-term real rate of interest, rex is the effective real exchange rate gap, Δrhp *is the change in real property prices and* Δrsp *is the change in real share prices. FCI weights are calculated by dividing the sum of the absolute value of the estimated coefficient of a variable by the sum of the absolute value of the estimated coefficients of all variables included in the FCI. Standard errors are in parentheses.*

The FCI weights derived based on the output gap regressions and those derived based on the output growth regression are also broadly similar, suggesting that model dependence is not a major issue. The real interest rate gets in each case the largest weight, followed by real property prices. The exchange rate appears to get a sizeable weight only in the euro area and in the UK. For cross country comparisons, the weights are very similar for the US, the euro area and the UK, while in Japan the weight of the real interest rate is larger than in the other countries.

In Figure 1 and 2 we plot four-quarter moving averages of the MCIs (dotted line), the FCIs (broken line) and respectively the output gap and the output growth rate (solid line). The base period for the MCIs and the FCIs is the first quarter 1998, the first out-of-sample period. The graphs suggest that over the in-sample period, 1982-1997, the FCI was a better leading indicator of economic activity than the MCI. In particular, the FCIs gave much stronger signals of weak demand prior to the economic downturn in the early 1990s than the MCIs.

A more interesting question is, of course, how the MCIs and FCIs performed out-of sample, in particular in predicting the recent economic downturn. Figure 1 and 2 reveal that the performance is mixed. The MCI failed to predict the slowdown in economic activity in all four cases, while the FCI predicted the downturn in Japan and the UK, but not in the US and the euro area. In the US, the MCI and the FCI stayed flat during the recent downturn or, in the case of the output growth model, even signalled an economic expansion rather than a weakening. This result is due to the high weight of house prices in the US FCI and the surprising strength of house prices during the recent downturn. The euro area FCI, as well as the MCI, signalled weaker economic activity only after the sharp drop in output growth in early 2000. In Japan, the FCI signalled an economic weakening for output growth, but not for the output gap. The Japanese MCIs stayed rather flat over this period. In the UK, the FCI signalled weak demand both for the output gap and for output growth around two quarters before economic activity started to slow down, while the MCIs rather signalled a slight improvement of demand conditions in 2001.

Figure 1: MCIs, FCIs, and Economic Activity: Output Gap

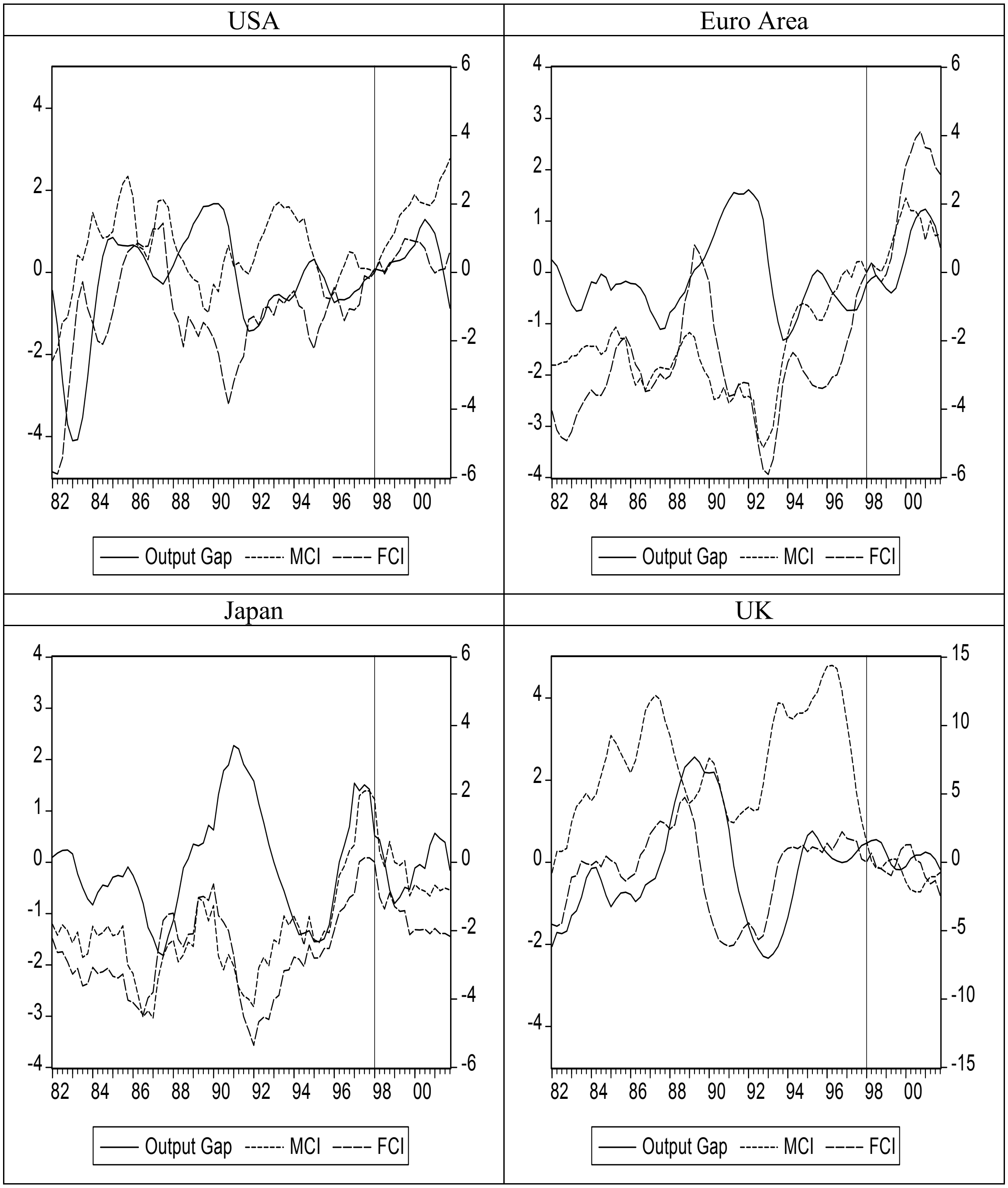
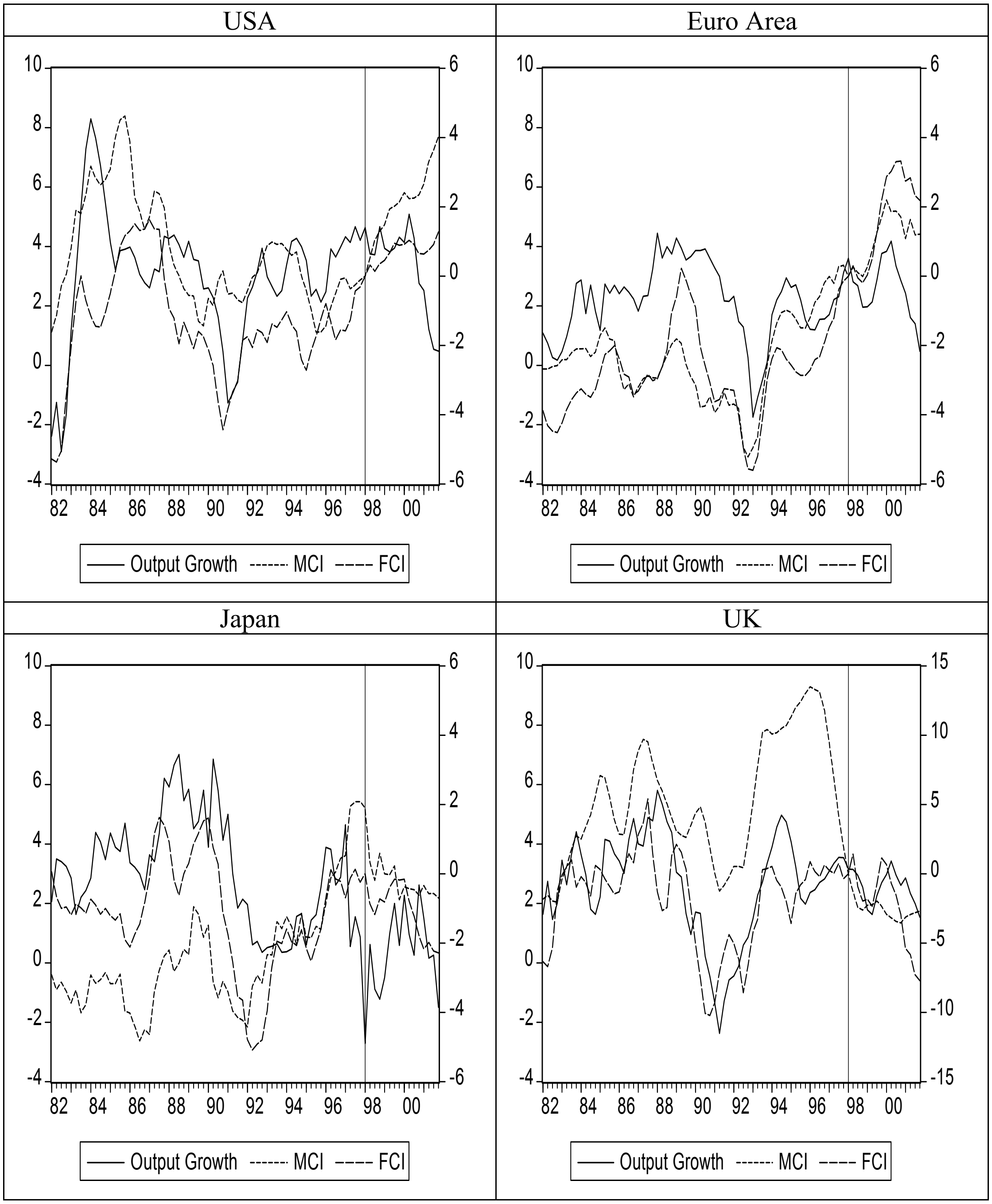


Figure 2: MCIs, FCIs, and Economic Activity: Output Growth



5. Conclusions

A Monetary Conditions Index (MCI), a weighted average of the short-term real interest rate and the real exchange rate, is a commonly used indicator of the stance of monetary policy. In the underlying class of models on which the MCI concept is based, the short-term real interest rate and the real exchange rate are the main determinants of aggregate demand. However, recent developments in theoretical and empirical research on the monetary transmission process suggest that property and equity prices may also play an important role in the transmission of monetary policy via wealth and balance sheet effects. This implies that an extended MCI, a Financial Conditions Index (FCI), also comprising property and share prices, may be a more useful composite indicator of monetary conditions than the standard MCI.

In this paper we construct MCIs and FCIs for the four largest economic areas of the world, the US, the euro area, Japan and the UK, using quarterly data over the period 1982-1997. The indices are derived based on coefficient estimates from reduced form aggregate demand equations. The results suggest that that the real interest rate and real property prices are important determinants of aggregate demand conditions, while the exchange rate and share prices are generally not found to have a significant effect on output. In-sample, FCIs appear to have been better indicators for the development of economic activity than the standard MCIs. Out-of sample the FCI also performs better than the MCI, but its overall performance is mixed. An FCI would have predicted the recent downturn in economic activity in Japan and the UK, but not in the US and the euro area.

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