BANK OF FINLAND DISCUSSION PAPERS

17 • 2001

David Mayes – Matti Virén
Research Department
19.9.2001

Financial conditions indexes

Suomen Pankin keskustelualoitteita
Finlands Banks diskussionsunderlag

http://www.bof.fi

Suomen Pankki
Bank of Finland
P.O.Box 160, FIN-00101 HELSINKI, Finland
☎ + 358 9 1831

BANK OF FINLAND
DISCUSSION PAPERS

17 • 2001

David Mayes – Matti Virén
Research Department
19.9.2001

Financial conditions indexes

Suomen Pankin keskustelualoitteita
Finlands Banks diskussionsunderlag

http://www.bof.fi

ISBN 951-686-735-9
ISSN 0785-3572
(print)

ISBN 951-686-736-7
ISSN 1456-6184
(online)

Suomen Pankin monistuskeskus
Helsinki 2001

Financial conditions indexes

Bank of Finland Discussion Papers 17/2001

David Mayes – Matti Virén
Research Department

Abstract

This paper provides an exposition of the nature, means of estimation and uses of Financial Conditions Indexes (FCIs) and their relationship to the more common Monetary Conditions Indexes (MCIs) that are used by market analysts, international organisations and central banks. Using panel datasets for Western Europe we explore how asset prices, particularly house and stock prices, can provide useful additional indicators of future changes in output and inflation. We find a clear role for house prices but a poorly determined relationship for stock prices. Unfortunately the most useful role for FCIs comes from their incorporation of high frequency data and the opportunity this gives for extracting information about changes in market expectations for inflation and output. This helps market participants make judgements about likely central bank reactions and helps central banks assess the stance of policy between forecasts. While stock prices are high frequency, house prices are not. At quarterly frequency central banks in particular will want to use traditional economic forecasting methods and summary indicators like FCIs will have only a limited role. We illustrate how such an FCI can be used, drawing on monthly data for Finland.

Key words: financial conditions, asset prices, house prices, stock prices

JEL classification numbers: E44, E58, E31

Rahoitusmarkkinoiden tilaa kuvaavat indeksit

Suomen Pankin keskustelualoitteita 17/2001

David Mayes – Matti Virén
Tutkimusosasto

Tiivistelmä

Tässä tutkimuksessa esitellään rahoitusmarkkinoiden tilaa kuvaavien indeksien (Financial Conditions Indexes, FCI) luonnetta, estimointia ja käyttöä sekä näiden indeksien suhdetta yleisemmin käytettyjen rahamarkkinoiden tilaa kuvaaviin indekseihin (Monetary Conditions Indexes, MCI). Näitä indeksejä käyttävät analyytikot, kansainväliset organisaatiot ja keskuspankit. Läntisen Euroopan maista kerättyä paneelidataa käyttäen selvitämme, missä määrin varallisuushinnat, erityisesti asuntojen ja osakkeiden hinnat, voivat olla hyödyllisiä tuotannon kasvun ja inflaation lisäindikaattoreita. Tutkimuksesta ilmenee, että asuntojen hinnoilla on tässä suhteessa selkeä merkitys, mutta osakkeiden hintojen yhteys näihin muuttujiin on heikko. Hyödyllisintä FCI-indeksien käyttö on kuitenkin silloin, kun se perustuu usein julkistettavien tilastoaineistojen hyväksikäyttöön ja sen mahdollistamaan markkinoiden ennusteiden määrittämiseen. Se taas auttaa markkinaosapuolia päättelemään, mitkä ovat keskuspankin todennäköiset reaktiot. Keskuspankkia se auttaa arvioimaan politiikan tilaa ennustekierrosten välillä. Osakkeiden hinnoista on saatavissa tiuhaan havaintoja, mutta asuntojen hinnoista ei. Neljännesvuositasolla erityisesti keskuspankit haluavat käyttää traditionaalisia ennustemenetelmiä ja siten rahoitusmarkkinoiden tilan indikaattoreilla on vain vähän käyttöä. Osoitamme tässä työssä, miten tällaisessa tapauksessa FCI-indeksiä voidaan käyttää tukeutuen Suomea koskevaan kuukausiaineistoon.

Asiasanat: rahoitusmarkkinoiden tila, varallisuushinnat, asuntojen hinnat, osakkeiden hinnat

JEL luokittelu: E44, E58, E31

Contents

1 Introduction

Financial markets have for many years used various indicators that seek to show in summary form the pressure that monetary policy is bearing on the economy. These indicators normally combine at least four readily available financial prices: a short (3 month) interest rate, a representative bond rate (10 years), the exchange rate and a stock price index. They are normally referred to as Financial Conditions Indexes (FCIs).[1] The logic behind these indexes is that they summarise the immediate impact of the central bank's policy instruments on financial prices, which in turn can be related to future output and inflation through the usual channels of the transmission mechanism.[2] These financial prices are important not just because they reflect wealth, which enters into key consumption and investment relationships, but because they incorporate market expectations of future price and output developments. Furthermore, unlike indicators primarily based on economic data, FCIs are continuously updated as financial markets trade.

Central banks themselves and international organisation such as the IMF, OECD and European Commission use Monetary Conditions Indexes (MCIs), which combine either the first three prices or just the short interest rate and the exchange rate (Mayes and Virén, 2000b). Stock and other asset prices are normally excluded either because the transmission channel is relatively unclear or because in practice it is difficult to observe the direct effect.[3] However, central banks pay considerable attention to stock market prices in their own right, as maintaining financial stability as well as price stability is part of their objective.[4] Stock price bubbles and their collapse can have serious problems for the economy, which policy might head off (King, 1994; Cechetti et al., 2000). As reflected in Alan Greenspan's famous remarks on 'irrational exuberance', the problem is to try to decide how much of such asset price changes seems to be justified.[5] An FCI offers a means of weighting the information.

In this paper we demonstrate, using an extensive database for west European countries, that this scepticism over the merits of including stock prices is well founded. The effects on output and inflation are small and the relationships poorly determined. However, an FCI can be constructed for these countries using data on house prices that contains considerably more information than in the equivalent MCI. Not only can we derive a plausible transmission channel through house prices but many articles have suggested that it is important not just for private financial institutions but also for central banks in setting monetary policy to bear

[1] The FCI at some time t, $FCI_t = \Sigma_i w_i(p_{it} - p_{i0})$, where p is the financial price, i = 1,2, ..., n representing each of the n prices, interest rates, the exchange rate etc. that are included, w is the weight assigned to each price. Period 0 is the base period on which the index is computed. These indexes are typically normalised to 1, 100 or 1,000 in the base period.

[2] Given this impact on future inflation some authors have argued that MCIs are best viewed as indicators of future inflation rather than of monetary policy (see Grande (1997) for a clear discussion).

[3] Roger (1993).

[4] Cechetti et al. (2000) advocate reacting to asset prices as a normal part of maintaining price stability and in Bryan et al. (2001) suggest how asset prices might be combined with other prices into an appropriate target. Bernanke and Gertler (1999) are much more cautious.

[5] The original remark was made in a speech in December 1996 and repeated in the semi-annual testimony to Congress the following February.

house prices in mind.[6] Unfortunately, while an FCI containing stock prices remains an indicator based on high frequency data, which can be updated continuously during trading hours, an FCI including house prices can only be updated periodically as most countries only have house price data on a quarterly or at best monthly basis.[7] However, given that international organisations and others taking a longer-term view normally only publish financial indicators at annual or at most quarterly frequency this is not a drawback.

We therefore derive FCIs using stock and house prices for EU countries in the ensuing sections and consider their merits. As there is no obvious explanation in the literature, Section 2 defines FCIs and explains how they can be compiled. Section 3 goes on to suggest how they can be used. This sets the context for our own estimation of the components of FCIs for the members of the European Economic Area (EU plus Norway, Iceland and Liechtenstein) in Section 4. After appraising the results we go on to construct an explicit FCI and consider its implications in Section 5.

2 Deriving FCIs

The key feature of the FCI (or MCI for that matter) is that it is a measure that draws on continuously updated financial market variables and is hence available on 'real time' basis for financial market participants. It will therefore employ 'benchmark' prices that are readily available in the market. The main value of the indicator is that it in turn is thought to be related to future values of economic activity or inflation. Thus it provides continuously updated information about the future, whereas traditional economic forecasts are only updated monthly or quarterly (or half yearly in the case of the published Eurosystem forecast).

Goldman Sachs provide a good illustration of how FCIs are compiled and used in practice. For a number of countries they use (in real terms) short rates (3 month), long rates (10 year government bond), and the trade weighted exchange rate for an MCI, adding the market capitalisation to GDP ratio (or a real all-share market index) to create an FCI.[8] With minor variations this is the normal list of financial variables, asset prices, included in an FCI. In the case of South Africa (Goldman Sachs, 2001) made a reason for calculating the indexes explicit 'We develop monetary and financial conditions indices for South Africa to reassess the bank's likely [monetary policy] response in the year ahead.' (The South African Reserve Bank refers to 'monetary conditions' in its *Monetary Policy Review*.)

[6] See Cecchetti et al. (2000) for a helpful survey. Previously house price information was both sparse and rather non-comparable but recent work by Iacoviello (2000) and Goodhart and Hofmann (2000) shows that newly available data enables us to build FCIs for the euro area. The European Mortgage Federation and the ECB are compiling up to date series so that current FCIs containing house prices could be maintained.

[7] It might in theory be possible to get high frequency data relating to the housing market if there are sufficient highly traded property companies in equity markets to form a representative subindex. However, this does not apply in general to our sample of countries and the poor experience with the overall stock market index may not bode well for the use of subindexes either.

[8] While it is rare to compute the weights behind FCIs or MCIs using nominal data, as this conflicts with the underlying economic theory, it is normal compute the value of the indexes themselves in nominal terms in the short run. MCIs and FCIs are measured compared to some arbitrary starting point. As deflators are measured for discrete intervals, either quarters or months, the nominal and real values will be the same inside that interval.

This particular reason provides quite a complex link between the indicator and future values of activity and inflation. We can decompose the link into three parts. First of all, the South African Reserve Bank is a conventional inflation targeter, in the sense that it sets its monetary policy instruments on the basis of the inflation that it expects in the future. It therefore uses models both to forecast what it expects to happen to inflation and to decide how the monetary policy instruments it has at its command (in effect the interest rate in the overnight money market) can affect future inflation. If the outlook for inflation at its current instrument setting is unacceptable in terms of the target then the Reserve Bank will change the setting until the result forecast is deemed to be acceptable. This does not of course mean that inflation will always be forecast to be on target, as the Bank may be unwilling or unable to make changes of sufficient magnitude.

The second part of the link is that the central bank's instrument affects a set of proximate financial variables that in turn affect inflation (given the other current and expected values of other variables that also affect inflation). These proximate variables are those listed in the FCI. The Bank's instrument is of course only one factor influencing the value of those variables. If the FCI does not include some variables that are an important part of the transmission mechanism of the setting of the monetary policy instrument through to inflation then the third part of the link will be weakened.

This final part of the link is that the observer can then infer likely future moves in monetary policy settings from shifts in the FCI and from shifts in their expectation of how the Reserve Bank's forecast will change. There will be a financial gain for anyone who can guess better than the market as a whole from this information. To take the simple case where nothing else in the forecast appears to have changed, then it would be possible to infer that, if there had been a significant move in the FCI, the Reserve Bank would reset interests rates in order to bring the FCI back to levels consistent with its inflation objective. Similarly, if it is thought that the central bank's forecast or requirements will change, then it is possible to compute backwards how the policy setting would have to alter. In practice of course both the expected forecast and the FCI will change. The FCI will change in response to the expectations of the market as a whole over both the future and the central bank's likely moves. Since central banks do not respond in a mechanistic manner, however much they believe their own forecasts and models, the inferences drawn through this complex link can easily be rather inaccurate.[9]

As Grande (1997) points out, these indicators are providing information about two things: – inflation and monetary policy. It depends on the user's objectives as to which of these objectives applies in any particular circumstance. As in any signal extraction problem in order to isolate the relevant information it is necessary not just to be clear about the objective but also to establish what other assumptions or conditions need to apply.

[9] As has been widely pointed out (Gerlach and Smets (1997); Jacobsen et al. (1998), for example) the impact of a shock on the MCI (and on the value of the MCI that the central bank thinks is appropriate for maintaining price stability) will depend on the source of the shock as well as its size. Hence in second-guessing the central bank market players have to make a judgement over what the bank will have decided with respect to both of these aspects, thus adding to the potential inaccuracy of their decision.

Instead of taking this argument further at this point, we go on first in this section to explain how FCIs can be derived and defer until section 3 the further exploration of how FCIs can be used, especially by central banks.

2.1 Determining the variables and their weighting in FCIs

There are two fairly obvious ways of determining the weights (relative importance) of the component variables in the index or indeed in deciding upon whether the variables should be included at all. The first, which Goldman and Sachs use, is to apply the approach explored in Stock and Watson (2000). This approach is largely atheoretic and simply asks the question of whether asset prices are leading indicators of real economic activity and inflation and if so how they can be combined to provide optimal forecasts. It is a prior condition that the variables included should cointegrate.[10] As Stock and Watson explain 'the optimal weights correspond to the theoretical regression coefficients in a regression of the true future value on the various forecasts'. Hence of course the weights will tend to vary according to how far ahead one is trying to forecast.[11] Goldman and Sachs appear to do this directly while Stock and Watson (2000) simply use the median forecast from the group of indicators.[12] This latter approach of course would not enable us to construct an FCI, although we could use it to produce 'real time' forecasts of output and inflation using the four component asset prices in the Goldman and Sachs index. In these circumstances one would publish the continuously updated forecast rather than the indicator. However, this in turn would have to be combined with the forecasts from other real activity, price, wage and money stock variables that one would normally include in modelling. The forecasts from these latter variables would of course only be updated at the discrete intervals at which new information for them becomes available.

The second and more conventional approach is to try to explain the mechanism by which the financial variables affect economic activity and inflation and then model that directly.

Asset prices are normally thought to feature in the transmission mechanism in three main ways. First of all they may be directly incorporated in the CPI either immediately or with a short lag. In so far as the CPI tries to cover expenditure then interest rates may enter through either credit charges or mortgage payments. On the whole this effect is avoided, explicitly in the case of the definition of the HICP (Harmonised Index of Consumer Prices) that is used by the ECB in its definition of price stability. However, some countries, such as Australia and New Zealand have had elements of interest rates directly in their CPIs. In both cases the central banks sought to eliminate these effects from their inflation targets by following some measure of 'underlying inflation' from which more volatile elements were stripped. (Including interest rates is particularly disastrous for monetary policy as the target will increase every time the central bank tightens

[10] Bryan et al. (2001) provide a different atheoretic approach in showing how asset prices can contribute to explaining the trend in inflation, using a 'dynamic factor index'.

[11] Mayes and Virén (2000b) show how these weights can vary according to the time horizon in the case of an MCI.

[12] It is worth noting why Stock and Watson use this rather more robust approach to combining forecasts. They find that the forecasting performance of various individual indicators is unstable. Hence although adding asset prices improves forecasts the appropriate weights vary over time.

monetary policy and would lead to a cycle of tightening, albeit a convergent one, with similar volatility in the downwards direction as inflation falls.)

The most common direct effect is from the exchange rate, as a large range of import prices will be affected by the exchange rate when prices are next reset in the domestic currency, mainly over the next 3 to 6 months. However, this pass through into the CPI is variable, partly according to the economic cycle (Baxter, 1994) and partly according to the perceived permanence of the exchange rate change. There is normally no direct stock market price effect on the CPI and it is rare for house prices to be directly included, although surveyors, real estate agents and others involved in transaction often make their fees proportionate to house prices. The price of building materials, paints, fittings etc. will also be affected by surges in the supply of houses (through DIY merchants) and that also tends to follow house prices but with a lag.

The second effect on the CPI comes indirectly through the impact on wealth and incomes. Wealth features directly in most consumption functions, so a proportion of rises in asset prices (falls in interest rates) will be translated into increases in spending. That increase in demand will in turn affect inflation, increasing it sharply as demand exceeds sustainable supply. Here the lags are longer and the main impact tends to come through one to two years ahead, although there is often substantial persistence.

Lastly asset prices may have an effect through the credit channel, affecting the ability of firms to raise capital to finance investment.[13] However, asset prices have a characteristic that is useful in the current context, namely that they incorporate an element of expectations. Thus they not only act as a leading indicator of future consumer prices because of the transmission mechanism but they enable us to work out what people expect to happen to inflation in the future. Inflation expectations can be backed out of the yield curve (Söderlind and Svensson, 1997). Since asset prices take account of the stream of future earnings during their lifetime, they will respond increase in expected productivity or other growth rates. Thus they have an important information value about the future both through the transmission mechanism and through what they reveal about what people expect.[14]

Goodhart (2001) and Goodhart and Hofmann (2000) provide a clear exposition of a straightforward means of representing the transmission mechanism and in doing so also give an eloquent explanation of why central banks should be concerned with asset prices when targeting inflation. They argue that it is possible to set up a simple IS or aggregate demand curve that explains the output gap in terms of the variables in the FCI (although they do not phrase it that way).[15] They do not include the 10-year bond rate from Goldman and Sachs (2001) list but they add real house prices.[16] This gives the real three month interest rate, the real exchange rate, stock prices and house prices as the four arguments in the function (both current and four quarter lagged values). The link to inflation is then

[13] See Bernanke and Gertler (1995) for a clear exposition.

[14] We do not consider addressing the problem through quantities rather than prices. How far one can go in using money, credit and other aggregates is widely debated, as Meltzer (1995), inter alia, explains.

[15] The form of the IS curve they employ is very similar to that used in Mayes and Virén (1998) and again here.

[16] Much of the literature concerned with house prices (Mayes, 1979; Iacoviello, 2000, for example) is concerned with what explains house prices, rather than their role in explaining subsequent inflation.

provided by an aggregate supply function in the form of a Phillips curve, where the determinants are lagged inflation and the output gap.[17]

The addition of house prices is crucial to the argument here and the dropping of the 10-year rate of only limited consequence as Mayes and Virén (2000b) show for most of the EU countries. House prices represent a variable that appears to form a part of the transmission mechanism that is not accounted for by the other variables. Including stock prices helps take account of some aspects of the credit channel and aspects of company sector wealth not accounted for by interest rates. House prices do the same for the household sector. For most households their house is their main asset, although this effect will be weakened in countries where renting is prevalent.[18] Although there is a clear link between interest rates and house prices and of course the impact of interest rates on households' cash flow dominated by mortgage payments[19] not all of the impact appears to be accounted for by the interest rate effect.[20]

This approach to establishing an FCI appears promising. Goodhart and Hoffman (2000) demonstrate for a set of 17 OECD countries over the period 1973–1998 (with some missing data in four cases) that in all countries except Italy changes in house prices have a clear effect on the output gap. In turn they are able to show a clear feedthrough from the output gap to inflation. Although it might be more appropriate to allow for nonlinearity and asymmetry in the Phillips curve (Mayes and Virén, 2000a) the relationship is robust.[21]

Stock prices on the other hand have a significant effect in only 8 out of the 17 countries. What is rather more surprising is that real interest rates only show significant coefficients in 9 cases and real exchange rates in 6. Only in the cases of Spain, the Netherlands and the UK can all four determinants be clearly separately identified. This illustrates a clear difficulty in building up FCIs from this information, as the determination of the weights would be fragile. The experience in developing MCIs successfully for an overlapping set of countries in Mayes and Viren (1998) suggests two problems. First that the relationship is not necessarily constant across different monetary policy regimes and second that the channels of influence of the four variables are interrelated. As Eika et al. (1997) point out, these sorts of IS curves present a wide range of problems for estimation, which require the resulting estimates to be treated with considerable caution.

---

[17] Gernberg (2001) inter alia demonstrates how the addition of the exchange rate can improve the operation of simple policy rules for central banks.

[18] As Maclennan et al. (1999) Table 1 shows there is considerable variation across the 11 European countries in our sample. Owner-occupation is the main form of tenure in all countries except Germany, where private renting and owner-occupation formed roughly equal proportions, the remaining quarter of tenure being 'social' renting. Owner-occupation only covers about half of dwellings in the Netherlands (most of the remainder being social renting) and co-operative ownership is common in Sweden. The percentages shown in Chuiri and Japelli (2000) (Table 6) based on survey data are similar but show a rather different profile across countries according to the age of the head of household.

[19] Outstanding residential mortgage debt amounted to over 50% of GDP in Denmark, Germany, Netherlands, the UK and Sweden according to Maclennan et al. (1999) using European Mortgage Federation data.

[20] The impact of this on perceived inflation dynamics will be particularly important for central banks like the Reserve Bank of New Zealand, whose models do not include house prices as such and measure wealth more generally (Black et al., 1997).

[21] Goodhart and Hofmann set out their two equations as the aggregate demand and supply curves in a structural model but as Rudebusch and Svensson (1998) point out this model could also be regarded as a restricted VAR.

The point of the Goodhart and Goodhart and Hofmann papers is somewhat different from our own. Although also concerned with the implications for monetary policy, the first conclusion is that it is appropriate to include asset prices in the target for monetary policy. While they do not extend this to stock prices, they explicitly argue for the inclusion of house prices in the CPI. This is a subject of hot debate among central banks and the Reserve Bank of New Zealand (1997) went to a great deal of effort to persuade Statistics New Zealand to exclude house prices from the CPI. (New Zealand was one of the few countries to include new house prices directly, rather than some measure of housing costs.) Less controversially, Goodhart and Hofmann go on to conclude that central banks would be well advised to pay more attention to current asset prices in deciding how to set monetary policy to control future inflation (a point well established in Cechetti et al. (2000) for example).[22]

The success of the Goodhart and Hofmann work helps confirm our own decision to continue to follow this second approach in extending our work on MCIs in Section 4. Using this form of economic model, rather than just concentrating on optimising the forecasting properties behind the FCI, not only helps clarify the reasoning behind choosing particular variables but also leads to a much more direct link with the ways in which some central banks set monetary policy, with the benefit of particular economic models.[23] Where forecasts from many models are combined either explicitly or implicitly as in the case of the Bank of England or the Eurosystem then the Stock and Watson route might be a better representation. It is certainly important to bear in mind their findings of instability when applying our approach.[24] However before moving on to the empirical results, we motivate the paper by exploring how FCIs can be used in practice, particularly by central banks.

[22] Here the debate is over whether one should seek to include asset prices in the target for monetary policy or in the 'rule' used for setting monetary policy (Genberg, 2001). As Svensson (2001) makes clear, target rules are to be preferred to instrument rules from a technical point of view, implying that asset prices should be in the target. However, the credibility of the target often depends on its simplicity to the general public and hence modification of the CPI by the central bank is usually unattractive. In such a case one either has to follow Goodhart (2001) and get the official statisticians to amend the CPI to include asset prices or use asset prices as information variables in the setting of policy with a typical unamended CPI. FCIs can form part of this second route.

[23] Among others, the Bank of Finland, the Reserve Bank of New Zealand, the Bank of Canada, the South African Reserve Bank and the Norges Bank are obvious examples.

[24] There are other well known routes for trying to incorporate the information, such as the VAR approach used by Iacoviello (2000) for six European countries. While his model is largely closed, using real income, inflation, real house prices, a nominal short-term interest rate and real money balances, it would be possible to extend it by including the exchange rate. Mayes and Virén (1998) explore a four variable VAR for the euro area and Jacobsen et al. (1998) a more extended exercise for Sweden. Neither, however, incorporates house prices. While a VAR/VECM representation may make it rather difficult to back out the appropriate weights for an FCI it does illustrate very clearly the differences in the ways different shocks to the economy affect both the components of an FCI and output and inflation.

3 Using FCIs in practice

In the previous section we explained how financial analysts use FCIs to try to second guess how central banks are going to set monetary policy. It is one thing for an outside institution to use indicators to try to estimate what is going on behind closed doors. (We argue elsewhere (Mayes, 1999; Tarkka and Mayes, 1999) that central banks should seek to be as transparent as possible, so as to minimise the costs to the economy from the private sector's errors in forecasting their behaviour.) It is quite another for the central bank itself to use such indicators when it has full access to the information that lies behind monetary policy decision-making.

In the main the usefulness of the FCI comes as an indicator using high frequency data in the period between forecasts but in a slightly more direct manner than for outside observers. Although the line of argument is clearest when forecasts are based on a single model or related group of models the reasoning applies to any updating process involving economic data. When the forecast is formed it will generate a base value for the FCI, which is consistent with the expected future and the current setting of policy. (It will also generate a future path for the FCI if the forecasting method allows variation in interest and exchange rates. In which case the consistent value of the FCI can vary for each discrete time period in the forecast.)[25] In the period before the next issue of economic data, when it will be possible to rerun the forecast properly, the central bank can observe how the components of the FCI and hence the FCI itself change. The FCI value will be an amalgam of information. On the one hand, in the absence of any shocks or 'news' it will tell us how much financial conditions are changing. Such changes will just represent 'noise' in the system and will have no consequences for policy or the real economy. If there is a shock to economic prospects the FCI will also change. This change will give an indication of what the markets see as the impact of the change, including their guess as to the likely reaction by the central bank. Their guess as to the central bank's reaction should be observable from the yield curve, so it should be possible to separate out the components (see Valckx (2001) for an exposition).

The problem for the central bank in observing what appears to be a shock from the movement of the FCI is to decide first of all what the shock is and secondly to judge whether the market's guess as to what the implications are for monetary policy is correct. When the movement of the FCI is sufficient to have a potential implication for policy then the central bank will react, either validating the shift implied by the yield curve or making clear what its (different) view actually is. Of course, the central bank might observe a shock and decide that this had implications for the setting of monetary policy even when the FCI did not shift, because the market did not regard the shocks as newsworthy. It is thus possible to get two pieces of information from the FCI, first on expectations and

[25] In Tarkka and Mayes (1999) we argue strongly for central banks (and other organisations for that matter) to produce forecasts that include the likely evolution of policy. If they do not they will be inconsistent with many of the inputs to the forecast, which are based on all the information available and not conditional on fixed interest or exchange rates – the conventional assumption. Having inconsistent forecasts will make it difficult to extract information from any indicator, such as an FCI, that is not conditioned in the same way.

second on the likely impact on inflation or the output gap from this source alone. Both of these help in the formulation of policy.

Shifts in the FCI without any identifiable cause or to an extent different from that estimated as appropriate by the central bank can be regarded as 'portfolio shocks' ie changes in the preferences of wealth holders. Large portfolio shocks will have an implication for policy.

It is essential not to get into the trap of assuming that all FCI movements imply the need for a shift in policy settings. In the case of the MCI, both the Bank of Canada and the Reserve Bank of New Zealand found (Freedman, 1995, for example) that the markets tended to take the implication of shocks rather mechanistically. They assumed for example that if the exchange rate rose, thereby increasing the MCI, then the central bank would want to see the interest rate fall to keep the MCI and hence the effect on inflation roughly constant. This of course would not be true if the exchange rate shift were itself a response to a shock. The central bank under those circumstances might want to see a change in financial conditions to offset the impact of the shock. If the FCI moves by what the central bank thinks is the appropriate amount then no policy reaction will be forthcoming. The market has already made the necessary adjustment. As a result, while the quotation of MCIs was designed to reduce the need for central bank intervention and to stabilise markets, it may have done the reverse (Svensson, 2001).[26]

The New Zealand and Canadian experience should thus make central banks careful in the way in which they refer to any FCIs or to financial conditions when describing the needs for policy. The Bank of Canada (Freedman, 1995) made it clear that the MCI was not some sort of intermediate target. There was only one target and that was inflation. The MCI (and hence any FCI) merely gives an indication of how monetary (financial) conditions are changing, from which all parties then have to draw inferences. The phraseology can be a little confusing, as Bank of Canada (1995) refers to 'using the MCI as an operational target of policy'. They define an operational target as 'a variable that the central bank can influence fairly directly when it changes the setting of its instrument variable'. However, this use was explicitly in the context of their macroeconomic model (Longworth and Poloz, 1995) and formed part of the quarterly forecasting process. The staff forecast for the Policy Board of the Bank included a track for the MCI over the coming few quarters that was consistent with achieving the Bank's inflation objective.

The RBNZ was even more cautious in introducing the concept of an MCI, as it had had the benefit of observing the markets 'over'-reaction in Canada. It appears from the arguments based on Goldman Sachs's FCIs, for example, that this lesson has been learnt. The FCI is a yardstick against which to judge central banks' likely non-mechanistic responses to changes in economic prospects.

FCIs, as we have described them, do not really play a useful role with respect to house prices. We establish in the next section that house prices appear to have an important role to play in the transmission mechanism and that we can estimate plausible weights for their inclusion in an FCI. However, as they are not continuously measured we would need to use them differently.

From the point of view of international organisations like the European Commission, IMF and OECD who use MCIs only to show the longer term

[26] This experience in finding that an attempt to clarify and simplify a complex issue can mislead runs counter to the simple trade-off put forward in Winkler (2000) as a reason for wanting to limit the 'transparency' of central banks.

evolution of the balance of monetary and fiscal measures in the pressure from macroeconomic factors the lower frequency presents no problem. The question at lower frequency is then why one should prefer an FCI to other measures. The principal reason that these organisations find is simply that it enables them to provide a summary in a single statistic of a number of different factors. It simplifies the discussion of monetary policy and the challenges it faces somewhat. This is thus to quite some extent a matter of external communication. It is quite a different question to ask what the central bank, or indeed other organisations, should do for their internal purposes where simplicity may not be at such a premium.

From the point of view of the central bank, it is an interesting question where in the sequence of decision-making the information on asset prices should be included. Presumably the ideal in the current framework is that the central bank's model should incorporate all of the transmission channels through to future inflation adequately, including current asset prices. They will then be appropriately weighted with all the other determinants and the dynamic structure. If current asset prices are incorporated in the target then the problem changes. First of all they tend to be more volatile so the target will itself tend to be more volatile. Current asset prices include information about current and future consumption prices. Using that information should help control future inflation not just in consumption prices but in the asset prices themselves. There is a major literature (Cechetti et al., 2000) about the extent to which central banks should seek to control asset prices because they have a tendency to overshoot (generate bubbles). The bursting of these price bubbles can then lead to sharp financial cycles and consequent disruption to the financial system. The central bank's duty to maintain financial stability as well as price stability can therefore be addressed simultaneously by including asset prices in the target.

How to deal with asset prices remains a contentious issue. What the discussion of the modelling approach to estimating the weights for an FCI does is offer a means of deciding upon the relative importance of the different sorts of asset price information. Whether one needs to go on and estimate the FCI itself for this context is less clear. We move on therefore to the first step of estimating the weights.

4 Estimating the weights for an FCI from european data

As we have surveyed above previous analysis has had difficulty in handling the whole range of asset prices in a single set of equations because of the different periodicity of the data. Stock, bond, money and exchange rate market data are available at high frequency and there is little difficulty in estimating models that use large numbers of data points. The problem comes in the economic variables to which they relate. In many countries inflation information is available monthly, as are data on some real variables. However, full models in a national accounting framework are at best quarterly so the higher frequency is not really such an advantage. Lower frequency then suffers from the problem of the short time period over which it is available. Monetary policy regimes have changed markedly over recent years, particularly in Europe. If we want to get estimates

that are relevant for the current euro area it is unlikely that data that predate the successful period of exchange rate targeting under the EMS will present a consistent picture. Mayes and Virén (1998) show that there are clear structural breaks and that IS and Phillips curves estimated across the two regimes tend to have poor explanatory properties.

We have therefore sought to add to the available information by looking instead at panel data for 11 European Economic Area countries over the period 1985 to 2000.[27] This of course substitutes one problem for another. Although it dramatically increases the amount of data we can use to estimate each equation without going outside a single regime it relies on the validity of hypotheses about similarities in behaviour of the different countries in the same time period. Earlier work in Mayes and Virén (2000a) suggests that this restriction can be accepted for a number of macro-economic relationships, including an extended version of the IS curve in Mayes and Virén (1998) that we discussed in section 2 above.

We therefore estimate an IS curve that has all the main asset prices of immediate interest (short-run interest rate, exchange rate, stock market price index, house prices) embedded in it. In effect this merely adds stock prices and house prices to the IS curve estimated in Mayes and Virén (2000b).

$$\triangle y_t = \alpha_0 + \alpha_1 \triangle y_{t-1} + \alpha_2 rr_{t-2} + \alpha_3 re_{t-2} + \alpha_4 \triangle yoecd_{t-1} + \alpha_5 \Delta hp_{t-1} + \alpha_6 \Delta sp_{t-1} + u_t,$$

where

$\triangle y$ = (log) output (GDP at constant market prices) gap, $\triangle yoecd$ is the OECD (log) output gap

rr = real interest rate (ie nominal 3 month rate minus annual inflation in the consumer price index, pc, %)

re = real exchange rate vis à vis US dollar (ie 100*log[e/(pc/pcusa)])

hp = log of house prices deflated by the consumer price index

sp = log of stock prices deflated by the consumer price index.

The estimates obtained for a sample of 11 members of the European Economic Area for the period 1985Q1 to 2000Q3 are set out in the first two columns of Table 1. The definitions of the data are given in the Appendix. The 11 countries are: Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, UK. Their choice partly reflects the ability to derive usable data for the common period but given that it covers over 90% of the EEA any element of adverse selection should be small.

However, not only is this data period rather short but it has been necessary to use approximated data from the BIS for house prices for 6 countries. Proper direct estimates of house prices were only available from official sources for the UK and the Nordic countries. We have, therefore, thanks to the kind help from the author, used a second data set from Iacoviello (2000) of house prices for five countries: Germany, Italy, Spain, Sweden and UK, covering the much longer time period 1972–1999. The results are shown in columns 3 to 6 of Table 1. The Iacoviello data are derived from some specific private sector sources: in Germany from the Aufina Residental price index; in Italy from the price index of magazine *Il Consulente Immobilare*; in Spain from the Ministerio de Economia y hacienda

[27] Goodhart and Hofmann (2000) and Iacoviello (2000) show results for individual European countries but do not combine the data.

Residental Price index; in Sweden from the Central Statistical Office House Price Index and in the UK from the Nationwide Anglia house price index.

In this case, while the data run across monetary policy regimes, they are for a rather longer period than has been possible in much previous work and hence give us some idea of how the relationship evolves over the economic cycle. This sub-group of countries also appears to have sufficient similarities to permit pooling of the data.

Finally, as noted above, the house price data are only usually available at most quarterly in the EEA countries. Since an FCI is most useful if computed continuously we show in the final column of Table 1 the results from using monthly data for Finland for which we also have monthly GDP estimates. Since most of the EEA countries do not have similar monthly data either on house prices or on the real sector it has not been possible to explore pooled estimates here. In any case it is likely that the short-run dynamics will vary across countries making pooling a more difficult hypothesis to sustain.

4.1 The nature of the results

It is clear from Table 1 that if one estimates this extended version of the IS curve for either the full sample of 11 countries or the extended data sample for the 5 countries the results are in general both consistent with earlier findings; systematically similar in terms of the additional variables and reasonably robust in terms of estimators and sample periods. The real interest rate and the real exchange rate (vis à vis the US dollar) enter the equation with reasonably sized and precise coefficients. The performance of these variables is quite the same for output gaps (labelled GAP in the Table) and log differences of output (the former being constructed with the Hodrick-Prescott filter). House prices are always significant and the coefficient is much larger than that for stock prices.

As is clear from Table 2 for the 11 country model and Table 3 for the 5 country extended data period estimates, adding the housing and stock market terms has a substantial effect on the relative importance of the real interest rate and real exchange rate in the regression. Column 1 in both tables shows λ, the ratio of the interest rate to the exchange rate coefficient. (λ is the key feature in MCIs showing the relative importance of the exchange rate in the transmission mechanism. In relatively closed economies like the United States or Japan the exchange rate is relatively unimportant, with values of λ around 8 or 10. In the EEA on the other hand values in the range 3 or 5 are more common and Mayes and Viren (1998) estimate that a value of the order of 3.5 could be applied to the euro area countries as a whole, using the US dollar exchange rate.) λ falls markedly in most cases when house prices and stock prices are added to the regression, as a result of a fall in the importance of the interest rate term.

Shortening the data period (Table 2) for the 11 countries has little impact on the house price coefficient and when the Iacoviello data are estimated for the same data period the coefficients are also similar (Table 3). Stock prices on the other hand show weak coefficients in all specifications, estimation methods and samples. While one might want to experiment further with the few cases of appropriate sign and magnitude of the coefficients, the existence of the wrongly signed and insignificant coefficients counsels caution. It is clear from other

studies (Goodhart and Hofmann (2000) and Goldman and Sachs (2001) for example) that it is possible to obtain satisfactory estimates for stock prices but that the weight in the subsequent FCI would be small, typically 10 percent or less.

All in all, one could conclude that house prices could perhaps be included in the FCI formula to take into account the effects of monetary policy more fully. Empirical evidence does strongly support the notion that (housing) wealth tends to boost output growth.[28] Technically, house prices will lower the weight of the real interest rate variable but the weights could still be considered to be rather reasonable. By contrast, stock prices perform so poorly that including them in the index would create considerable conceptual and measurement problems.

All these estimates need to be treated with care. One problem in backing the weights for the FCI out of an IS curve is that this ignores the channels of monetary policy through to inflation not captured by the arguments in the curve. Put another way round. A simple Phillips curve as used by Goodhart and Hofmann (2000) only accounts for between half and three quarters of the variation inflation in their sample of 17 OECD countries. Given that in turn estimates of the output gap from the IS curve only account for two thirds to three quarters of the variation, there are clear limitations to the inferences that can be drawn.

5 Applying an FCI in practice

If we look at the case of Finland in a little more detail we can see from Fig. 1 that house prices and stock markets seem to move in a fairly similar manner, which may help explain why it is difficult to find clearly separate influences in the IS curve. It is, however, important to note that the scale for stock prices is three times that of house prices, showing how much more volatile the stock market has been over the period (largely as a result of the movements in technology stocks, principally Nokia).

It is arguable that in looking for financial indicators one should look for those that are more sensitive to external forces. The Finnish housing market as a whole reflects the tension in the Finnish economy with strong growth in some parts of the country and decline in the rural areas. Eastern Finland for example is one of the unemployment blackspots for the EU as a whole. If we take the Helsinki area on its own, Fig. 2, then we can see an even closer match with the stock market figures. There is also a clear discrepancy in the years 1986–1990. This coincides with the generation and realisation of the financial crisis. Stock prices did not participate in the domestic bubble, aided by the international reverse in October 1987. Thus in this period house prices are a rather better indicator of the overall financial pressures on the economy than stock prices. For the last decade or so the relationship between the two series has become close. Thus, it may well be that the choice of the particular wealth price for the FCI is not so important in terms of the computation of FCI weights.

The question whether to use house prices or stock prices is not trivial. From the practical point stock prices are, of course, superior. They are available in real

[28] Why then has this effect not been taken into account in previous studies? Probably largely because of data reasons; high-frequency house price data do not seem to exist for major European countries. Currently the ECB is starting to gather these data which may allow their use in constructing the proper index.

time – in the same way as other input variables in the MCI. The problem with stock prices is, of course, how to measure the prices. Which stock exchanges and individual stocks should be taken into account?[29] How should the stocks of large multinational companies be treated? Although there are measurement problems with house prices too, the problems are more practical than conceptual. House prices have a clear connection to the country of origin. Thus, an index for EU wide house price developments still makes sense while it is not all clear that an EU wide stock price index has a similar interpretation. Stock markets across the world are much more integrated as investment in stocks can flow relatively freely across borders. Many of those holding shares on the Finnish stock exchange will not be Finns (70% according to Fig. 3) so the translation between Finnish stock prices and Finnish wealth in stocks will be indirect. By the same token it is likely that Finnish wealtholders will be accessing foreign markets direct and that a portion of their wealth will be reflected in other stockmarket indices. This same dichotomy will apply at the EU level. Changes in net foreign asset holdings occurring through capital flows will tend to be picked up by exchange rate movements in the equation. The switch towards US assets is evident in Fig. 4 for example.

Given our failure to estimate a satisfactory stock price coefficient for Finland we illustrate in Fig. 5 what an FCI using house prices would look like and how this relates to using an MCI or just interest rates. Although the general pattern is similar, as interest rates have the dominant weight in both the MCI and the FCI, it is clear that until recent years the addition of the further variables tended to increase the amplitude of the fluctuation in overall financial conditions. In the period since the start of Stage 3 of EMU this no longer appears to be the case. The rise in interest rates after the initial decline in 1999 has been more than offset by the fall in the exchange rate. However the increase in house prices has in turn offset some of the exchange rate effect. If we go outside the estimation period then the discrepancies continue to be of interest. If stock prices had been included then even with a low weight there would have been a noticeable difference as Helsinki stock prices trebled between early 1999 and early 2000 before showing an equally dramatic decline. The swiftness of the change and its reversal seems to mean that this increase in wealth had little opportunity to be converted into spending, illustrating the care with which any of these indicators needs to be interpreted.

FCIs are not necessarily more volatile than MCIs just because they include stock market indicators. The components are weighted and inclusion of a stock market index may reduce the weight on other volatile components. Hence making use of a wider range of asset prices to inform policy may actually be more stable than just focusing on the more traditional items. Reacting to asset prices may also be stabilising for the economy but this is a broader concern (Cechetti et al., 2000; Goodhart and Hofmann, 2000).

[29] Not only are there problems about which index to use to represent a single market (all share versus top 50 for example) but in some countries there is more than one exchange. As the Neue Markt indicates these can move in very different patterns.

6 Concluding remark

The results from using pooled data for most of the European Economic Area to explore the role of asset prices in explaining the output gap and inflation are promising. House prices in particular are helpful in providing information in addition to that contained in interest rates and the exchange rate. It would therefore seem sensible to include the effect through house prices in any indicator of the pressures from the monetary side of the economy on future activity and inflation. We show how a Financial Conditions Index for Finland adds to the information available from a traditional Monetary Conditions Index. The results seem robust to differences in data and time period. The effect from stock market prices is much more difficult to disentangle and their inclusion would tend to be somewhat speculative and involve rather a low weight.

This finding presents somewhat of a dilemma for the use of Financial Conditions Indexes. These indexes are at their most valuable in being continuously updated summaries of market information for the main transmission channels of monetary and financial variables through to inflation. As such they show how markets perceive the implications of shocks to the economy not just for future output and inflation but also for monetary policy. This continuous monitoring of expectations is also helpful for the central bank in formulating policy as it has to decide whether these market movements are consistent with the maintenance of price stability. Most economic data are quarterly or at best monthly and so economic forecasts can normally only be meaningfully updated at these longer intervals.

House price data are just such economic data, available only quarterly or monthly, while stock price data are continuous – at least while markets are open. Hence adding the house price data to an MCI provides helpful additional information but not at high frequency. Stock market information is high frequency but sufficiently noisy that it is not clear that its inclusion would improve the indicator. We therefore endorse the view of Goodhart and Hofmann (2000) and Cechetti et al. (2000) that useful information for monetary policy can be extracted from house prices. It would therefore be valuable to compile aggregatable house price data across EU at relatively high frequency. However, their inclusion in an FCI would be rather more as a generalised indicator, as MCIs are used by international organisations such as the IMF, OECD and European Commission currently. Central banks are likely merely to want to include them as part of the normal economic modelling, whether they use them as part of the process of price determination or, more controversially, as part of prices to be stabilised.

References

Baxter, M. (1994) **Real Exchange Rates and Real Interest Differentials: Have we Missed the Business Cycle Relationship?** Journal of Monetary Economics, vol. 33, 5–37.

Bernanke, B. – Gertler, M. (1995) **Inside the Black Box: the Credit Channel of Monetary Transmission.** Journal of Economic Perspectives, vol. 9 (4), 27–48.

Bernanke, B. – Gertler, M. (1999) **Monetary Policy and Asset Price Volatility.** in New Challenges for Monetary Policy, Federal Reserve Bank of Kansas City, 77–128.

Black, R. – Cassino, V. – Drew, A. – Hansen, E. – Hunt, B. – Rose, D. – Scott, A. (1997) **The Forecasting and Policy System: the Core Model.** Reserve Bank of New Zealand Research Paper 43.

Bryan, M.F. – Cechetti, S.G. – O'Sullivan, R. (2001) **Asset Prices in the Measurement of Inflation.** De Nederlandsche Bank Staff Report no. 62.

Byangos, V. (2000) **A Real Monetary Conditions Index for the Philippines: Is It Useful?** Institute of Social Studies, The Hague Working Paper no. 309.

Cechetti, S.G. – Genburg, H. – Lipsky, J. – Wadhwani, S. (2000) **Asset Prices and Central Bank Policy.** Geneva Report on the World Economy no. 2, International Center for Monetary and Banking Studies and CEPR.

Chiuri, M.C. – Jappelli, T. (2000) **Financial Market Imperfections and Home Ownership: a Comparative Study.** Working Paper 44, Centre for Studies in Economics and Finance, University of Salerno.

Eika, K.H. – Ericsson, N.R. – Nymoen, R. (1997) **Hazards in Implementing a Monetary Conditions Index.** Oxford Bulletin of Economics and Statistics, vol 58 (4), 765–790.

Genburg, H. (2001) **Asset Prices, Monetary Policy and Macroeconomic Stability.** De Nederlandsche Bank Staff Report no. 64.

Gerlach, S. – Smets, F. (1996) **MCIs and Monetary Policy in Small Open Economies under Floating Rates.** BIS, mimeo.

Goldman, S. (2001) **South Africa: Easier Monetary Conditions Limit Room for Rate Cuts in 2001.** EMEA Economics Analyst, issue 01/05, 6–8.

Goodhart, C.A.E. (2001) **What Weight Should Be Given to Asset Prices in the Measurement of Inflation?** Economic Journal, vol. 111 (June), F336–357.

Goodhart, C.A.E. – Hofmann, B. (2000) **Asset Prices and the Conduct of Monetary Policy.** Sveriges Riksbank and Stockholm School of Economics conference on Asset Markets and Monetary Policy, Stockholm, June.

Grande, G. (1997) **Properties of the Monetary Conditions Index.** Banca d'Italia Temi di Discussione no. 324.

Iacoviello, M. (2000) **House Prices and the Macroeconomy in Europe: Results from a Structural VAR Analysis.** European Central Bank Working Paper no. 18, April.

Jacobsen, T. – Jansson, P. – Vredin, A. – Warne, A. (1998) **A VAR Model for Monetary Policy Analysis in a Small Open Economy.** Sveriges Riksbank.

King, M. (1994) **Debt Deflation: Theory and Evidence.** European Economic Review, vol. 38, 419–435.

Mayes, D.G. (1979) **The Property Boom.** Oxford: Martin Robertson.

Mayes, D.G. (1999) **The Evolution of Voluntary Rules for the European Central Bank.** Contemporary Politics and Economics of Europe, vol. 8 (4), 357–386.

Mayes, D.G. – Virén, M. (1998) **The Exchange Rate and Monetary Conditions in the Euro Area.** Bank of Finland Discussion Paper 27/98.

Mayes, D.G. – Virén, M. (2000a) **Asymmetry and the Problem of Integration in the Euro Area.** Bank of Finland Discussion Paper 11/2000.

Mayes, D.G. – Virén, M. (2000b) **The Exchange Rate and Monetary Conditions in the Euro Area.** Weltwirtschaftliches Archiv, vol. 136 (2), 199–231.

Meltzer, A.H. (1995) **Monetary, Credit and (Other) Transmission Processes: a Monetarist Perspective.** Journal of Economic Perspectives, vol. 9 (4), 49–72.

Muellbauer, J. (1992) **Anglo-German Differences in Housing Market Dynamics: The Role of Institutions and Macroeconomic Policy.** European Economic Review, vol. 36, 539–548.

Reserve Bank of New Zealand (1997) **Recommendation to the 1997 CPI Revision Advisory Committee.** (May) http://www.rbnz.govt.nz/cpi.htm.

Roger, S. (1993) **Asset Prices and Monetary Policy.** Mimeo, Reserve Bank of New Zealand.

Rudebusch, G. – Svensson, L.E.O. (1998) **Policy Rules for Inflation Targeting.** NBER Working Paper 6512.

Stock, J. – Watson, M. (2000) **Forecasting Output and Inflation: the role of asset prices.** Sveriges Riksbank and Stockholm School of Economics conference on Asset Markets and Monetary Policy, Stockholm, June.

Söderlind, P. – Svensson, L.E.O. (1997) **New Techniques to Extract Market Expectations from Financial Instruments.** Journal of Monetary Economics, vol. 40 (2), 373–429.

Svensson, L.E.O. (2001) **What is Wrong with Taylor Rules? Using Judgement in Monetary Policy through Targeting Rules.** Mimeo July.

Tarkka, J. – Mayes, D.G. (1999) **The Value of Publishing Official Central Bank Forecasts.** Bank of Finland Discussion Paper 22/1999.

Valckx, N. (2001) **Factors affecting asset price expectations: fundamentals and policy variables.** Bank of Finland Discussion Paper 13/2001.

Winkler, B. (2000) **Which Kind of Transparency? On the Need for Clarity in Monetary Policy Making.** European Central Bank Working Paper no. 26.

Table 1. **Estimates of the new IS curve with panel cross-country data**

	GAP	Δlogy	GAP	GAP	Δlogy	Δlogy	Δlog(y)
y(–1)	.795	–.068	.713	.820	.152	.159	.525
	(31.33)	(1.61)	(26.51)	(29.30)	(3.49)	(2.62)	(8.15)
rr	–.013	–.033	–.006	–.017	–.022	–.026	–.013
	(1.26)	(3.20)	(0.80)	(2.24)	(2.91)	(1.74)	(1.28)
re	.007	.014	.006	.011	.011	.014	.003
	(2.42)	(4.76)	(2.50)	(3.91)	(4.02)	(4.13)	(1.85)
yoecd	.112	.341	.311	.231	.493	.387	.091
	(2.28)	(4.04)	(6.86)	(4.45)	(5.94)	(4.12)	(2.95)
Δhp	.043	.060	.069	.058	.070	.062	.004
	(4.60)	(6.12)	(5.31)	(5.45)	(5.30)	(4.80)	(2.95)
Δsp	.002	.007	–.004	–.001	–.001	–.003	–.003
	(0.68)	(2.27)	(1.19)	(0.59)	(0.37)	(0.109	(0.54)
R^2	.729	.246	.628	.803	.484	.423	.734
100*see	.761	.825	1.002	.621	1.267	0.711	1.234
DW	2.036	2.009	2.059	1.946	2.009	2.145	1.918
period	1985–2000	1985–2000	1972–1999	1987–1999	1972–1999	1987–1999	1987–2001
N/obs	11/540	11/540	5/468	5/240	5/468	5/240	1/171

y(–1) denotes the lagged dependent (output) variable. The two first columns correspond to the 11 country sample, the subsequent four columns the five country (Iacoviello data) sample and the last column to Finnish monthly data for 1987M1–2000M3. With the Finnish data, the foreign output variable is monthly US industrial production. Variables are as defined in the text although the definition of y depends on whether the output variable is the output gap or the change in output as indicated by the column headings. N denotes the number of countries and obs the total number of observations in the regression

Table 2. **Alternative estimates with the European cross-country panel data**

Data/estimator/N	(λ)	House prices	Stock prices	R^2/DW
Output gap	1.97	.043	.002	.729
SUR, 540	(.002)	(4.60)	(0.68)	2.036
Output gap	3.28	–	–	.694
SUR, 612	(.000)			1.950
Output gap	4.78	–	–	.695
GLS, 612	(.000)			2.042
Output gap	4.37	–	–	.695
OLS, 612	(.000)			2.018
Output gap	2.94	.042	–.006	.700
SUR, 402*)	(.000)	(4.50)	(1.61)	1.961
Output gap	4.48	.057	–.004	.704
GLS, 402*)	(.000)	(3.07)	(0.94)	1.976
Output gap	2.13	.045	–.002	.701
OLS, 402*)	(.000)	(3.52)	(0.55)	2.043
Output gap	2.97	.047	–	.699
SUR, 402*)	(.000)	(3.99)		1.962
Output gap	3.17	–	–	.692
SUR, 417*)	(.000)			1.934
Output gap	2.59	–	–	.692
GLS, 417*)	(.000)			2.061
Output gap	5.28	–	–	.695
OLS, 417*)	(.000)			1.969
Δlog(y)	2.34	.060	.007	.247
SUR, 540	(.000)	(6.13)	(2.27)	2.009
Δlog(y)	3.55	–	–	.174
SUR, 611	(.000)			1.863
Δlog(y)	4.44	.107	.004	.231
SUR, 402*)	(.000)	(3.23)	(1.02)	1.921
Δlog(y)	4.15	–	–	.206
SUR, 416*)	(.000)			1.954

The equations also include the lagged dependent variable and the (lagged) OECD output variable. *) The sample period is 1991Q1–2000Q3. Otherwise, it is 1985Q1–2000Q3. N denotes the number of observations. Δlog(y) indicates that log differences are used instead of the output gap variables.

Table 3. **Additional estimates with the Iacoviello house price data**

Data/estimator/N	λ	λ_R	House prices	Stock prices	R^2/DW
Output gap	0.89	6.41	.069	–.004	.628
SUR, 72-99, 464	(.019)	(.049)	(5.31)	(1.19)	2.059
Output gap	1.70	4.34	.067	–.003	.628
GLS, 72-99, 464	(.020)	(.060)	(5.09)	(0.85)	2.074
Output gap	1.62	1.04	.058	–.001	.803
SUR, 87-99, 236	(.000)	(.000)	(5.45)	(0.59)	1.936
Output gap	2.08	1.15	.054	–.001	.802
GLS, 87-99, 236	(.000)	(.000)	(4.68)	(0.27)	2.004
Δlog(y)	1.97	2.66	.070	–.001	.484
SUR, 72-99, 464	(.000)	(.203)	(5.20)	(0.37)	2.009
Δlog(y)	1.76	1.03	.069	–.001	.483
GLS, 72-99, 464	(.000)	(.245)	(5.20)	(0.22)	2.024
Δlog(y)	1.08	1.03	.062	–.003	.423
SUR, 87-99, 236	(.000)	(.046)	(4.80)	(0.10)	2.145
Δlog(y)	0.95	0.75	.064	.000	.418
GLS, 87-99, 236	(.000)	(.000)	(4.80)	(0.14)	2.223

λ and λ_R indicate the ratio of real interest rate and real exchange rate coefficients. (λ_R) indicates the (not reported) case in which house and stock prices are excluded from the estimating equation. (notice that the two λ values are not strictly comparable because of different data samples). Numbers inside parentheses under λ and λ_R are marginal significance levels for the Wald test $\alpha_2 = \alpha_3 = 0$.

Data Appendix

11 countries
Belgium
Denmark*)
Finland*)
France
Germany
Italy
Netherlands
Norway*)
Spain
Sweden*)
UK*)
---
*) genuine house price data: For other countries, the annual data are BIS data while quarterly variation is derived from quarterly residental investment prices.

The data are for 1985Q1–2000Q3. The output data are seasonally adjusted.

In Tables 2 and 3, the MCI weight parameter λ is simply α_2/α_3.

Figure 1. **House and stock prices in Finland 1970–2000**

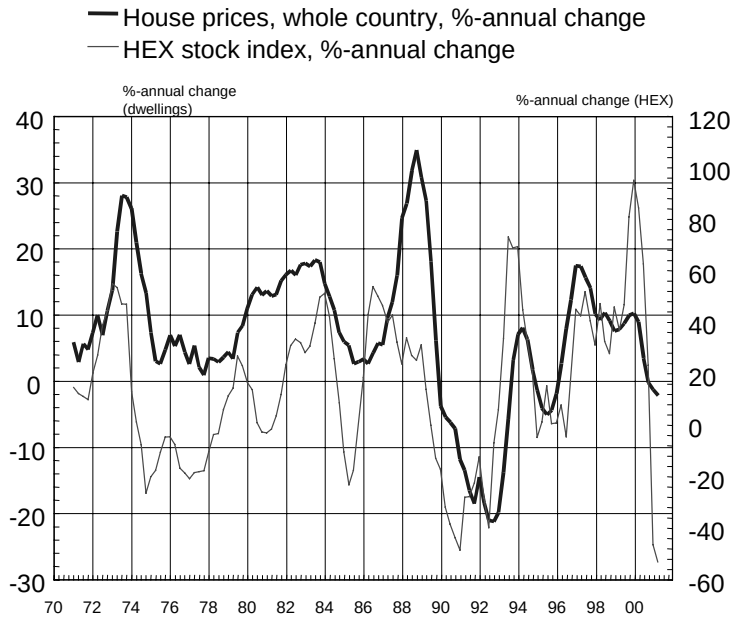


Figure 2. **House and stock prices in the Helsinki metropolitan area**

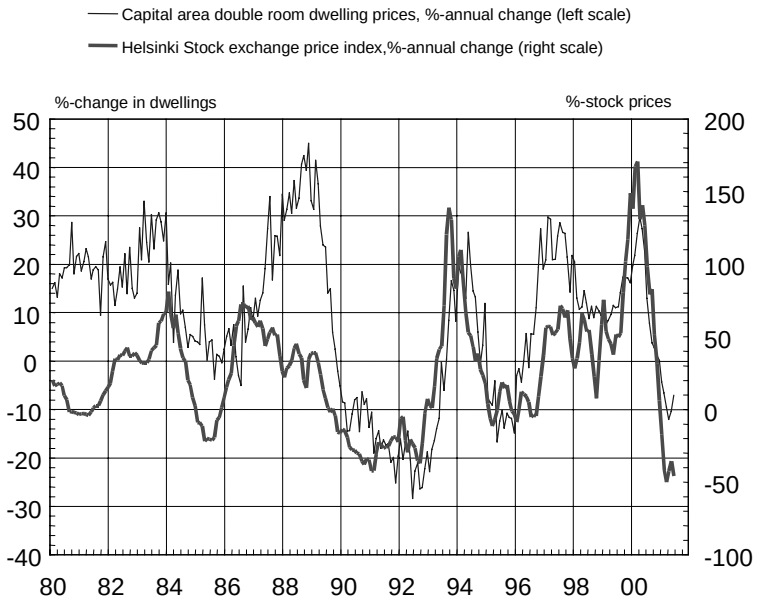
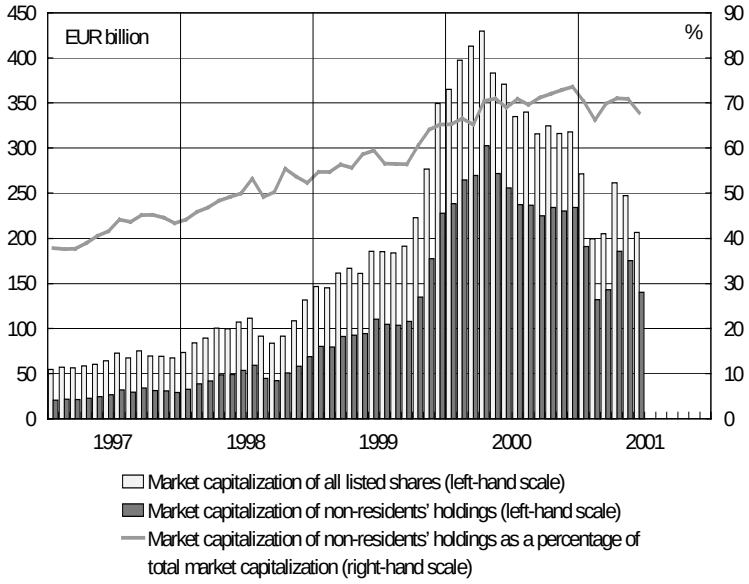


Figure 3. **Listed shares in Finland: total market capitalisation and non-residents holdings**



Sources: Finnish Central Securities Depository and Helsinki Exchanges.

Figure 4. **Annual rate of change of the USD/FIM exchange rate and the Dow-Jones stock price index**

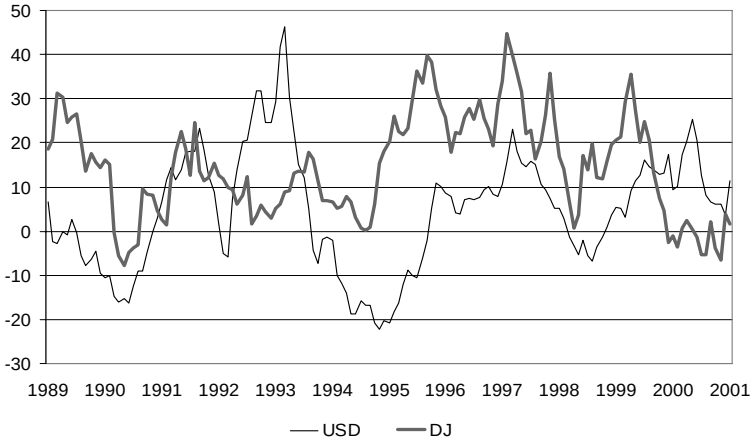
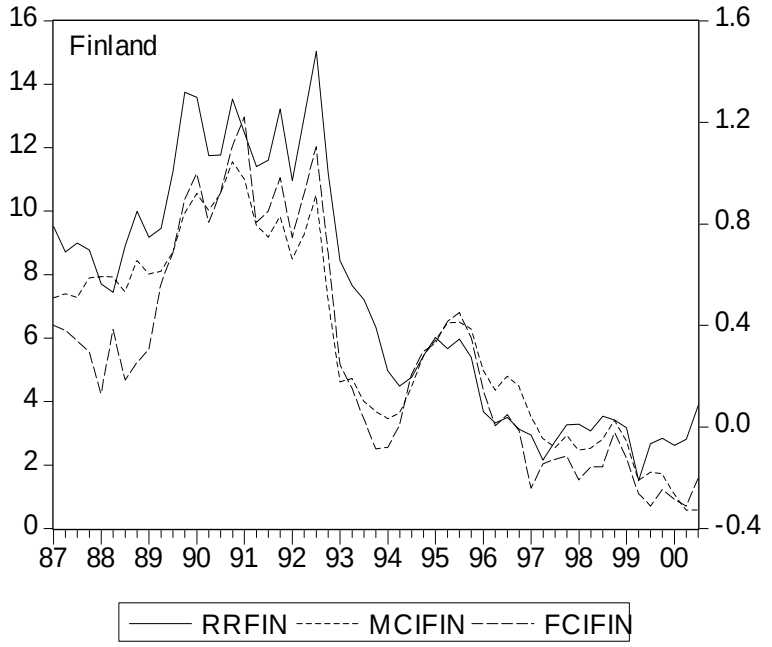


Figure 5. **Illustration of the difference between the real interest rate (rr), the monetary conditions index and the financial conditions index (FCI) for Finland**



RRFIN= real interest rate (Finland)
MCIFIN = weighted average of the real interest rates and the real exchange rate (using estimated panel data weights)
FCIFIN = weighted average of rrfin, refin and $\Delta\log(HP/PC)$ (using estimated panel data weights)
The real interest rate is measured on the left axis, MCI and FCI on the right axis. Weights are the pooled cross-country weights. Note that the indexes for MCI and FCI have not been rescaled – they just represent the impulses of the corresponding variables [thus, e.g. FCI = $\alpha_2 rr_t - \alpha_3 re_t - \alpha_5 \Delta\log(HP/PC)_t$].

BANK OF FINLAND DISCUSSION PAPERS

ISSN 0785-3572, print; ISSN 1456-6184, online

1/2001 Risto Herrala **An assessment of alternative lender of last resort schemes.** 2001. 28 p. ISBN 951-686-701-4, print; ISBN 951-686-702-2, online. (TU)

2/2001 Esa Jokivuolle – Karlo Kauko **The new basel accord: some potential implications of the new standards for credit risk.** 2001. 23 p. ISBN 951-686-703-0, print; ISBN 951-686-704-9, online. (RM)

3/2001 Mika Kortelainen **Actual and perceived monetary policy rules in a dynamic general equilibrium model of the euro area.** 2001. 76 p. ISBN 951-686-705-7, print; ISBN 951-686-706-5, online. (TU)

4/2001 Martin Ellison **Stabilisation bias in monetary policy under endogenous price stickiness.** 2001. 20 p. ISBN 951-686-707-3, print; ISBN 951-686-708-1, online. (TU)

5/2001 Erkki Koskela – Rune Stenbacka **Equilibrium unemployment with credit and labour market imperfections.** 2001. 35 p. ISBN 951-686-709-X, print; ISBN 951-686-710-3, online. (TU)

6/2001 Jarmo Pesola **The role of macroeconomic shocks in banking crises.** 2001. 61 p. ISBN 951-686.713-8, print; ISBN 951-686-714-6, online. (TU)

7/2001 Anssi Rantala **Does monetary union reduce employment?** 2001. 36 p. ISBN 951-686-715-4, print; ISBN 951-686-716-2, online. (TU)

8/2001 Tuomas Välimäki **Fixed rate tenders and the overnight money market equilibrium.** 2001. 72 p. ISBN 951-686-717-0, print; ISBN 951-686-718-9, online (TU)

9/2001 Morten L. Bech – Kimmo Soramäki **Gridlock resolution in interbank payment systems.** 2001. 34 p. ISBN 951-686-719-7, print; ISBN 951-686-720-0, online (RM)

10/2001 Antti Ripatti – Jouko Vilmunen **Declining labour share – Evidence of a change in the underlying production technology?** 2001. 43 p. ISBN 951-686-721-9, print; ISBN 951-686-722-7, online (TU)

11/2001 Michael Ehrmann – Martin Ellison – Natacha Valla **Regime-dependent impulse response functions in a Markov-switching vector autoregression model.** 2001. 24 p. ISBN 951-686-723-5, print; ISBN 951-686-724-3, online (TU)

12/2001 Jenni Koskinen **Yksityisasiakkaiden maksuliikepalvelujen hinnoittelu Suomessa.** 2001. 46 p. ISBN 951-686-725-1, print; ISBN 951-686-726-X, online (RM)

13/2001 Nico Valckx **Factors affecting asset price expectations: fundamentals and policy variables.** 2001. 42 p. ISBN 951-686-727-8, print; ISBN 951-686-728-6, online (TU)

14/2001 Jan Annaert – Marc J.K. DeCeuster – Nico Valckx **Financial market volatility: informative in predicting recessions.** 2001. 21 p. ISBN 951-686-729-4, print; ISBN 951-686-730-8, online (TU)

15/2001 Esa Jokivuolle – Samu Peura **A value-at-risk approach to banks' capital buffers: An application to the new Basel Accord.** 2001. 22 p. ISBN 951-686-731-6, print; ISBN 951-686-732-4, online (TU)

16/2001 Juha-Pekka Niinimäki **Should new or rapidly growing banks have more equity?** 2001. 36 p. ISBN 951-686-733-2, print; ISBN 951-686-734-0, online. (TU)

17/2001 David Mayes – Matti Virén **Financial conditions indexes.** 2001. 31 p. ISBN 951-686-735-9, print; ISBN 951-686-736-7, online. (TU)