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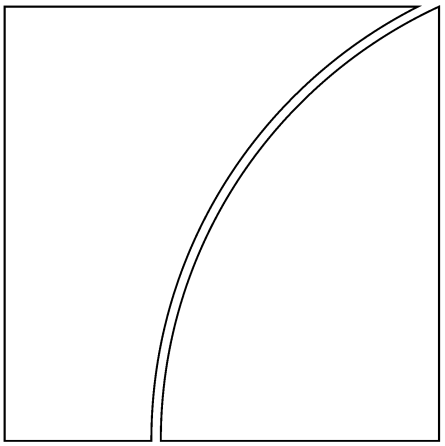

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Asset prices, financial and monetary stability: exploring the nexus

by Claudio Borio and Philip Lowe

Monetary and Economic Department

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Foreword

On 6th March 2002 the BIS organised a conference on “Changes in Risk Through Time: Measurement and Policy Options”. The conference brought together central bankers, supervisors, academics and market participants to exchange views on this issue (see the conference programme and list of participants at the back of this document). This paper was presented at the conference and, as such, is now released in the BIS working paper series. Other contributions will be released once the final versions become available.

Abstract

This paper argues that financial imbalances can build up in a low inflation environment and that in some circumstances it is appropriate for policy to respond to contain these imbalances. While identifying financial imbalances ex ante can be difficult, this paper presents empirical evidence that it is not impossible. In particular, sustained rapid credit growth combined with large increases in asset prices appears to increase the probability of an episode of financial instability. The paper also argues that while low and stable inflation promotes financial stability, it also increases the likelihood that excess demand pressures show up first in credit aggregates and asset prices, rather than in goods and services prices. Accordingly, in some situations, a monetary response to credit and asset markets may be appropriate to preserve both financial and monetary stability.

Table of contents

1. Introduction

Economic historians will no doubt look back on the last twenty years of the 20th century as those that marked the end of a long inflationary phase in the world economy. Burnt by the experience of the 1970s, policy makers had put in place credible institutional safeguards against monetary instability. They had done so by endowing central banks with clear mandates to maintain price stability and with the necessary autonomy to pursue them. And yet, the same decades will in all probability also be remembered as those that saw the emergence of financial instability as a major policy concern, forcing its way to the top of the international agenda. One battlefront had opened up just as another was victoriously being closed. Ostensibly, lower inflation had not *by itself* yielded the hoped-for peace dividend of a more stable financial environment.

Is this confluence of events coincidental? What is the relationship between monetary and financial stability? What is an appropriate policy framework to secure both simultaneously? These are some of the questions that we begin to explore in this paper.

There are many possible routes that can be taken to arrive at the heart of these issues. Given the focus of this conference, we start from asset prices. Medium-term swings in asset prices have historically accompanied episodes of widespread financial instability. And in recent years the question of whether monetary policy should respond to asset price "bubbles" has been asked with increasing frequency. Opinions on the subject are just as divided as ever.

We would like to make three points.

First, posing the question in terms of the desirability of a monetary response to "bubbles" per se is not the most helpful approach. Widespread financial distress typically arises from the unwinding of financial imbalances that build up disguised by benign economic conditions. Booms and busts in asset prices, whether characterised as "bubbles" or not, are just one of a richer set of symptoms. It is the *combination* of these symptoms that matters. Other common signs include rapid credit expansion and, often, above-average capital accumulation. These developments can, jointly, sow the seeds of future instability. As a result the financial cycle can amplify, and be amplified by, the business cycle.

Second, while not disputing the fact that low and stable inflation promotes financial stability, we stress that financial imbalances can and do build up in periods of disinflation or in a low inflation environment. One reason is the common positive association between favourable supply-side developments, which put downward pressure on prices, on the one hand, and asset prices booms, easier access to external finance and optimistic assessments of risk, on the other. A second is that the credibility of the policymakers' commitment to price stability, by anchoring expectations and hence inducing greater stickiness in price and wages, can alleviate, at least for a time, the inflationary pressures normally associated with the unsustainable expansion of aggregate demand. A third is that by obviating the need to tighten monetary policy, such conditions can allow the build up of imbalances to proceed further.

Third, achieving monetary and financial stability requires that appropriate anchors be put in place in both spheres. In a fiat standard, the only constraint in the monetary sphere on the expansion of credit and external finance is the policy rule of the monetary authorities. The process cannot be anchored unless the rule responds, directly or indirectly, to the build up of financial imbalances. In principle, safeguards in the financial sphere, in the form of prudential regulation and supervision, might be sufficient to prevent financial distress. In practice, however, they may be less than fully satisfactory. If the imbalances are large enough, the end-result could be a severe recession coupled with price *deflation*. While such imbalances can be difficult to identify ex ante, the results presented in this paper provide some evidence that useful measures can be developed. This suggests that, despite the difficulties involved, a monetary policy response to imbalances as they build up may be both possible and appropriate in some circumstances. More generally, co-operation between monetary and prudential authorities is essential.

The outline of the paper is as follows. In Section 2 we document changes in asset prices since the 1970s in a sample of industrial countries. We focus on equity and property prices and present an aggregate asset price index that can serve as a summary measure of asset price developments. In Section 3 we begin to explore more systematically the relationship between financial and real imbalances, on the one hand, and financial instability, on the other. By stressing cumulative processes, we examine to what extent symptoms of financial instability can be detected *ex ante* in a sample of 34 industrial and middle-income emerging market economies. In Section 4 we then consider the relationship between monetary and financial stability, laying out the conceptual nexus and drawing

on some descriptive empirical evidence. In Section 5 we assess the policy implications. Finally, the conclusions highlight some open questions and issues for future research.

2. Asset prices: relevance, measurement and stylised facts

Relevance

Until at least the early 1990s there seemed to be a certain disconnect in the way the economics profession treated asset prices. On the one hand, asset prices stood out in historical accounts of financial instability (see Section 3). In these accounts it is property prices in particular that have been highlighted, although in some accounts equity prices have figured prominently. On the other hand, the mainstream macroeconomics literature examining the link between asset prices and the macro-economy focused almost exclusively on equity prices. Even then, efforts concentrated primarily on understanding the role of equity prices in affecting consumer expenditures, with less attention being paid to their impact on the cost of capital; the work pioneered by Tobin was the main exception.[1]

This disconnect is puzzling for a number of reasons. If asset prices swings are a significant cause of financial instability, presumably they should also play a prominent role in determining the level and composition of aggregate demand. Likewise, a much larger proportion of household wealth is typically held in the form of real estate than equity. And commercial property accounts for a sizeable fraction of firms' assets.

During the last decade this disconnect has began to narrow. Conceptually, the literature on imperfections in the markets for external funding based on information asymmetries has lent intellectual respectability to accounts of the transmission of financial impulses to the real economy that stress the role of asset prices, not least as implicit or explicit measures of collateral.[2] Likewise, the increased incidence and macroeconomic costs of financial instability since the 1980s in industrial and emerging markets has helped to focus attention on the importance of asset prices.[3] Even so, empirical work on the relationship between credit and asset prices, or of the effect of changes in real estate prices on aggregate demand, is still quite limited.[4]

Measurement

This comparative neglect helps to explain why available data on property prices are scarce. In fact, when the BIS started to collect them systematically in 1990, obtaining comparable series proved exceedingly hard.[5] Even today, some ten years on, while progress has been made in terms of coverage and quality, it has been far from satisfactory. There is, for instance, hardly any reliable data covering a sufficiently long period for emerging market countries. And comparability across countries is hampered by the heterogeneity of the series (e.g. national averages vs. main cities, basis for the calculation of the price). This dearth of statistics makes it difficult to carry out rigorous cross-country empirical analysis and virtually impossible to address some specific questions.

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1 The seminal article on this is Tobin (1969).

2 The literature is now extensive, including contributions by Greenwald, Stiglitz and Weiss (1984), Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). For surveys, see Gertler (1988) and Bernanke et al (1999). The role of asset prices, however, has a long tradition, including Keynes (1931) and, more recently, Kindleberger (1995).

3 See e.g. IMF (1998), Bordo et al (2001) and Hoggarth and Saporta (2001).

4 Examples of work on the relationship between credit and asset prices include Blundell-Wignall and Bullock (1993), Borio at al (1994), Goodhart (1995), Hofmann (forthcoming). Borio (1997) and BIS (1995) provide some evidence on the cross-country use of real estate as collateral and on its possible link to the transmission mechanism of monetary policy. However, the evidence here is very limited. In a cross-country exercise, the link between real estate prices and consumer expenditure is analysed by Kennedy and Andersen (1994), which in addition contains a useful bibliography; see also Maclennan et al (1998). In the light of recent experience, the Federal Reserve Board is studying this link in more detail, (Greenspan (2001).

5 See, for instance, the BIS Annual Report (1990).

At the same time, the data now available do allow an examination of trends in asset prices in several industrial countries since the 1970s. In order to do so, we follow two different methodologies. The first is to look at representative series for three separate asset classes, namely equities, residential property and commercial property. The second is to combine these separate series into an aggregate price index, weighing the components by estimates of the shares of the asset classes in private sector wealth.[6]

The aggregate asset price index, which the BIS has used since the early 1990s[7], has at least two merits. It provides a useful and readily available proxy for changes in wealth. And, as a summary measure, it can reveal common patterns or relationships hidden by the possibly divergent behaviour of individual series.

On the other hand, the heterogeneity of the components is also the main weakness of the index. Notably, the impact on financial stability and economic activity varies across the constituent asset classes and depends on circumstances, such as the extent of changes in the individual series and the structure of balance sheets of both financial and non-financial entities.

The bottom line is that the aggregate asset price series should be best thought as a complement to, rather than substitute for, the individual series. And, ultimately, the proof of the pudding is in the eating.[8]

Stylised facts

Graphs 1 and 2 show the performance of the aggregate asset price index and, separately, of its components (equity prices, residential real estate and commercial real estate) in a dozen industrial countries. The data generally go back to the early 1970s but in some cases statistics for commercial real estate are only available from the 1980s. Moreover, for proprietary reasons, for some countries the behaviour of commercial property prices prior to 1980 cannot be shown explicitly, although it is subsumed in the corresponding aggregate index. All series are deflated by consumer prices, so as to portray inflation-adjusted magnitudes. The following stylised facts are worth noting.

- As might have been expected, equity prices are the most volatile, followed by commercial and residential property in that order. As a weighted average, the aggregate asset price index falls somewhere in between the extremes. Given the typical weights in the series, it is mostly affected by residential property prices and, to a lesser extent, equity. The weight of the latter, however, has increased considerably since the 1990s.
- Country-differences aside, one can generally see two completed major cycles and, prospectively, one under way, in sympathy with real economic activity. These cycles are especially evident in the aggregate index. They correspond, respectively, to the early to mid-1970s, the mid-1980s to early 1990s, and the second half of the 1990s to the present. Japan, of course, has not taken part in the latest upswing following the reversal of the asset price inflation at the turn of the 1990s and the subsequent "lost decade".
- These cycles appear, if anything, to be growing in amplitude and length.

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[6] The methodology is described in detail in Borio et al (1994). The development of the first aggregate asset price index is due to Callen (1991).

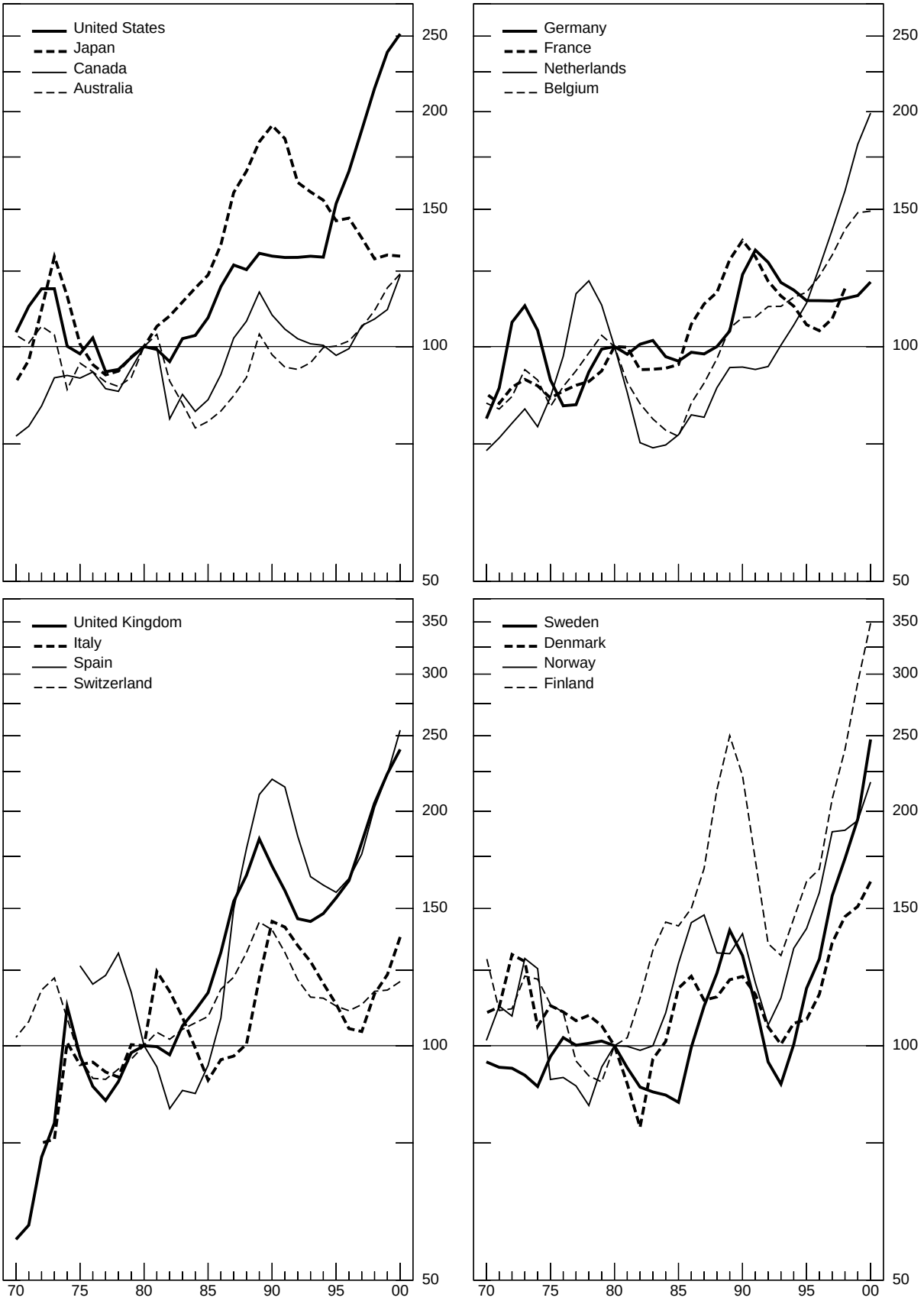
[7] The aggregate asset price index first appeared in a BIS publication in its Annual Report (1993), which included a chapter examining developments in asset prices in the 1970s and 1980s, analysing their determinants and considering the policy implications.

[8] Borio et al (1994) examine the usefulness of the index in investigating the link between credit and asset prices, as an indicator of future movements in output and inflation, and as a determinant of the demand for money.

Graph 1

Real aggregate asset prices

1980 = 100; semi-logarithmic scales

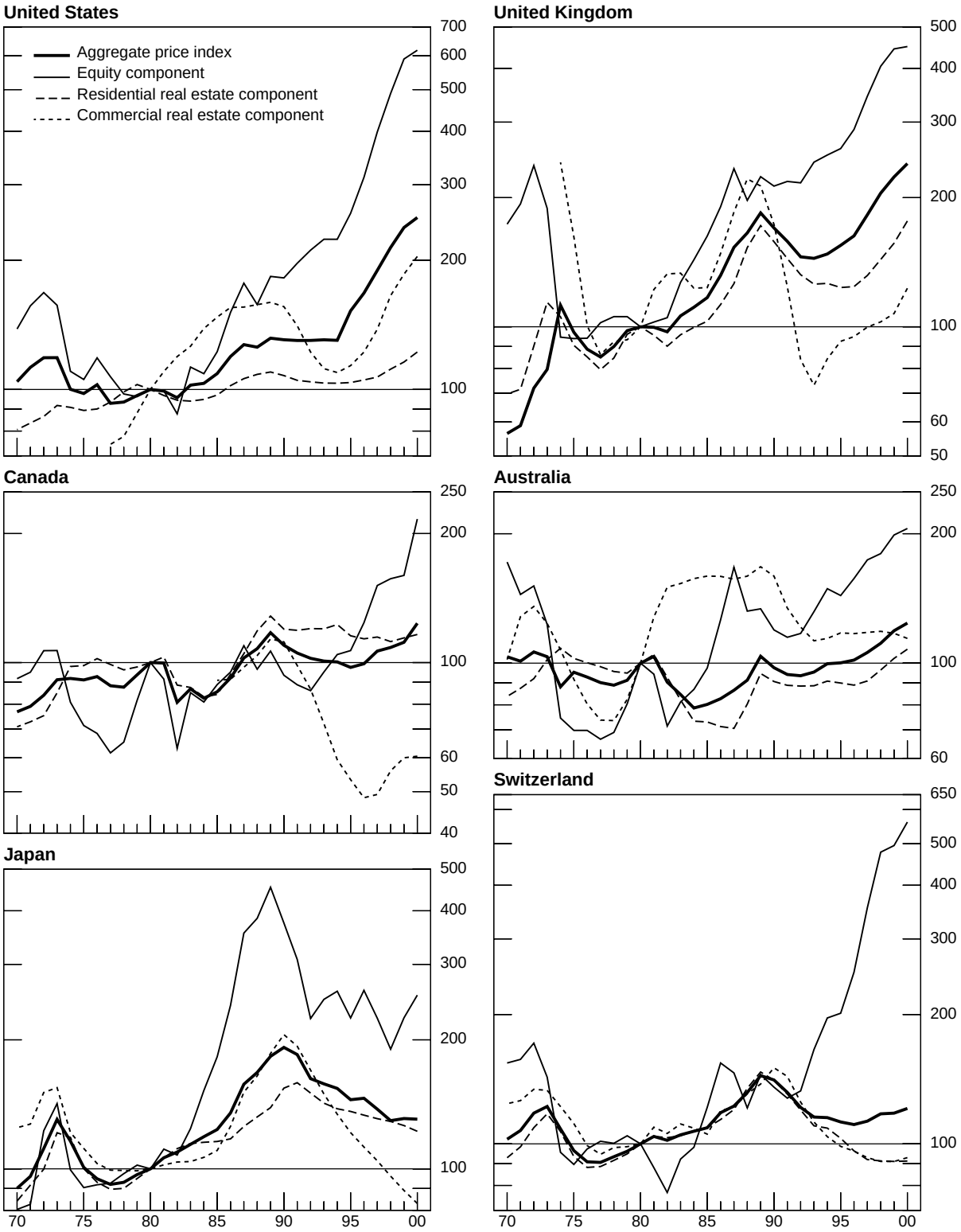


Note: For an explanation of the methodology and sources, see the notes to Graph 2.

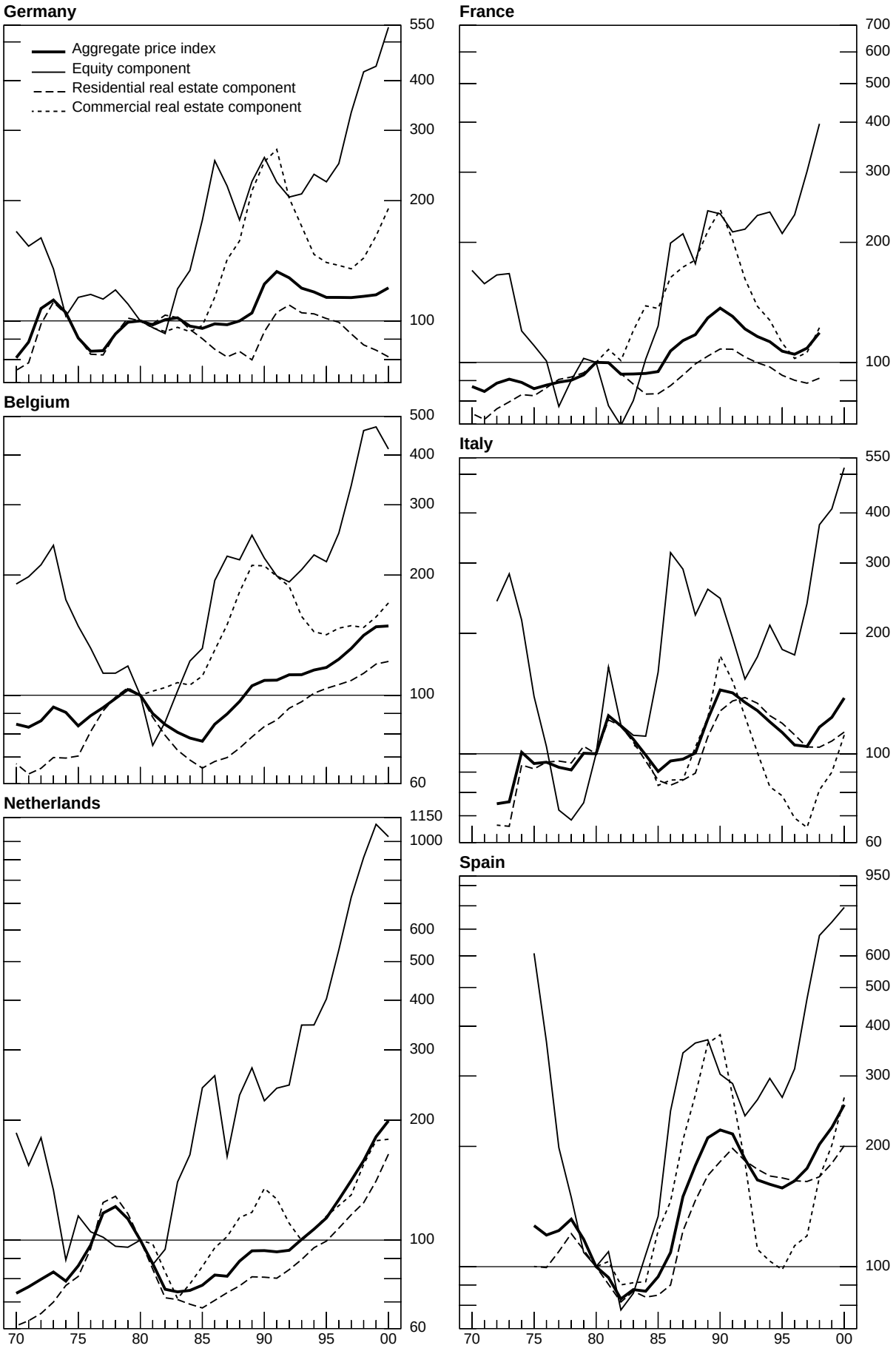
Graph 2

Real asset prices: aggregate and components

1980 = 100; semi-logarithmic scales



Graph 2 (cont)


Germany
Aggregate price index
Equity component
Residential real estate component
Commercial real estate component
550
400
300
200
100
France
700
600
500
400
300
200
100
Belgium
500
400
300
200
100
60
Italy
550
400
300
200
100
60
Netherlands
1150
1000
600
500
400
300
200
100
60
Spain
950
600
500
400
300
200
100
70
75
80
85
90
95
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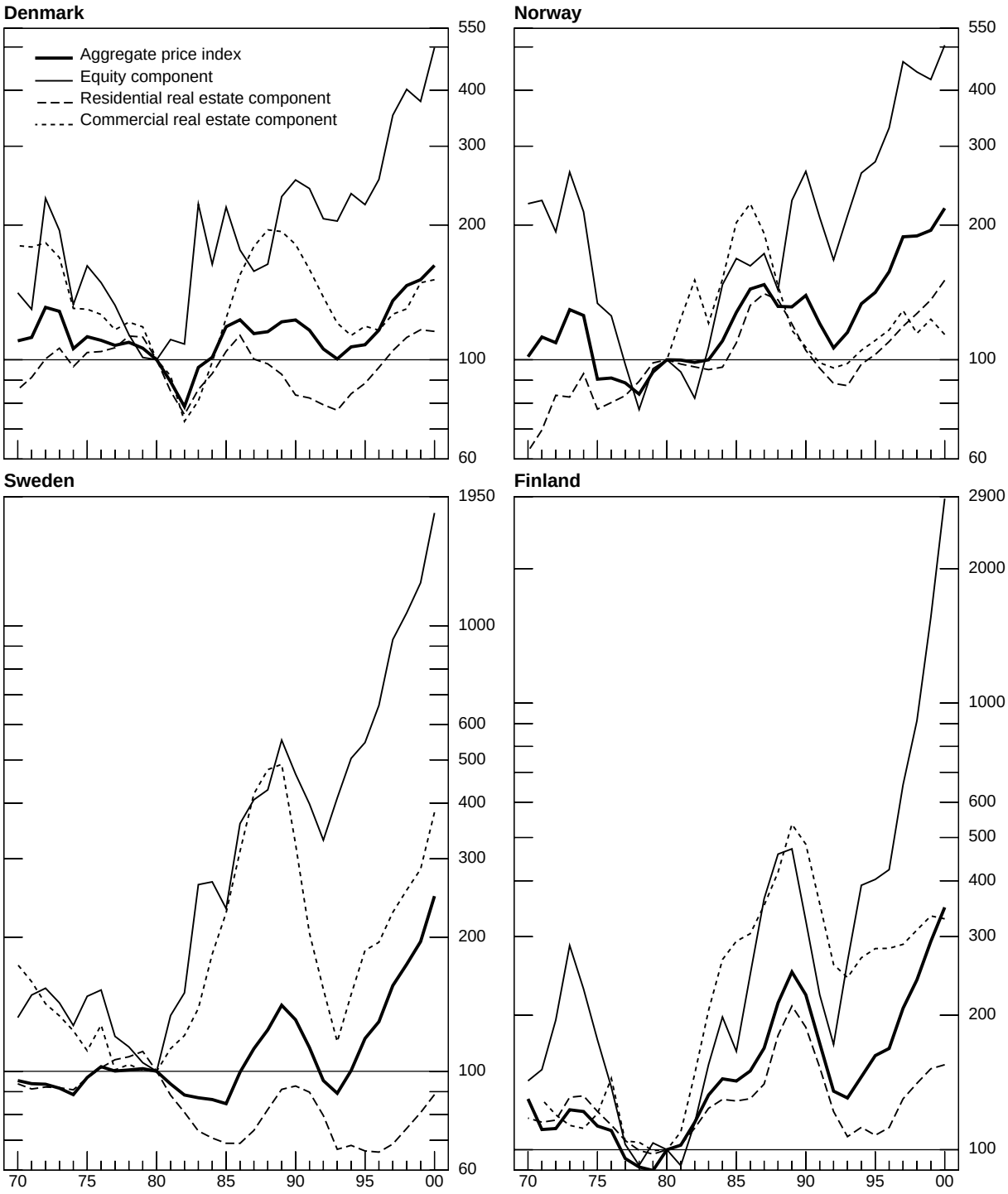
Graph 2 (cont)



Notes: The aggregate price index is calculated as a weighted geometric mean of the three components. The weights are based, where available, on net wealth data, but in some cases are supplemented by the price change of each component; the calculation uses 5-year windows (6-year for 1995 weights) starting in 1970. Where one component is not available, the geometric mean is calculated on the other two. For the purpose of rebasing, for Italy and Canada, the 1980 level of commercial real estate prices has been estimated. For Belgium, France, Germany, the Netherlands and Norway, the commercial real estate component is not shown in the 1970s as it is proprietary information.

Sources: Private real estate associations (inter alia, Jones Lang LaSalle); national data; BIS estimates and calculations.

- In the current upswing, equity markets have been particularly strong. With some exceptions, property prices have remained more subdued.
- Typically, peaks in equity prices tend to lead by one to two years those in real estate prices. Residential property prices are normally those that turn last. The relationship is somewhat less clear-cut around troughs.
- It is not difficult to discern a relationship between large swings in asset prices and subsequent strains in the financial sector or the real economy. This was true in a number of countries in the 1970s (e.g., the secondary banking crisis in the United Kingdom) and again at the turn of the 1990s. In some cases these episodes were accompanied by widespread financial distress, such as in the Nordic countries or Japan. But even when actual failures of institutions were limited or non-existent, the financial system and the economy came under considerable stress. The experience of the United States, the United Kingdom and Australia in the early 1990s stand out in this respect.[9]
- Major medium-term swings in asset prices have tended to go hand in hand with similar cycles in credit expansion (Graph 3).

3. Asset prices and credit: threats to financial stability?

What do we know?

Large swings in asset prices figure prominently in many accounts of financial instability. Indeed, a boom and bust in asset prices is perhaps the most common thread running through narratives of financial crises. This is true for both industrial and emerging market countries alike. Typical examples in recent decades include Latin America in the late 1970s-early 1980s, the Nordic countries in the late 1980s, and East Asia in the mid to late 1990s. These experiences are of course not new. In many respects the descriptions of the Australian boom and bust of the 1880-1890s, for example, could be used with only limited editing to describe some of the more recent episodes of financial instability.[10] Likewise, while perhaps more controversial, the experience of the United States in the late 1920s-early 1930s also exhibits similar features.[11]

Despite the importance of asset price developments, they have received relatively little attention in the recent empirical literature examining the determinants of banking system crises. To a large extent this reflects the lack of adequate cross-country data already mentioned. Formal cross-country econometric tests of the links between asset price cycles and financial stability are severely hampered, and at best limited to equity prices.[12]

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[9] See e.g. Greenspan (1991), Bank of England Quarterly Bulletin (1991), Blundell-Wignall and Bullock (1993), Gizycki and Lowe (2000) and, for an overview, O'Brien and Browne (1992). For evidence of a credit crunch beyond the banking sector in the Unites States, specifically in the private placements market, see Carey et al (1993).

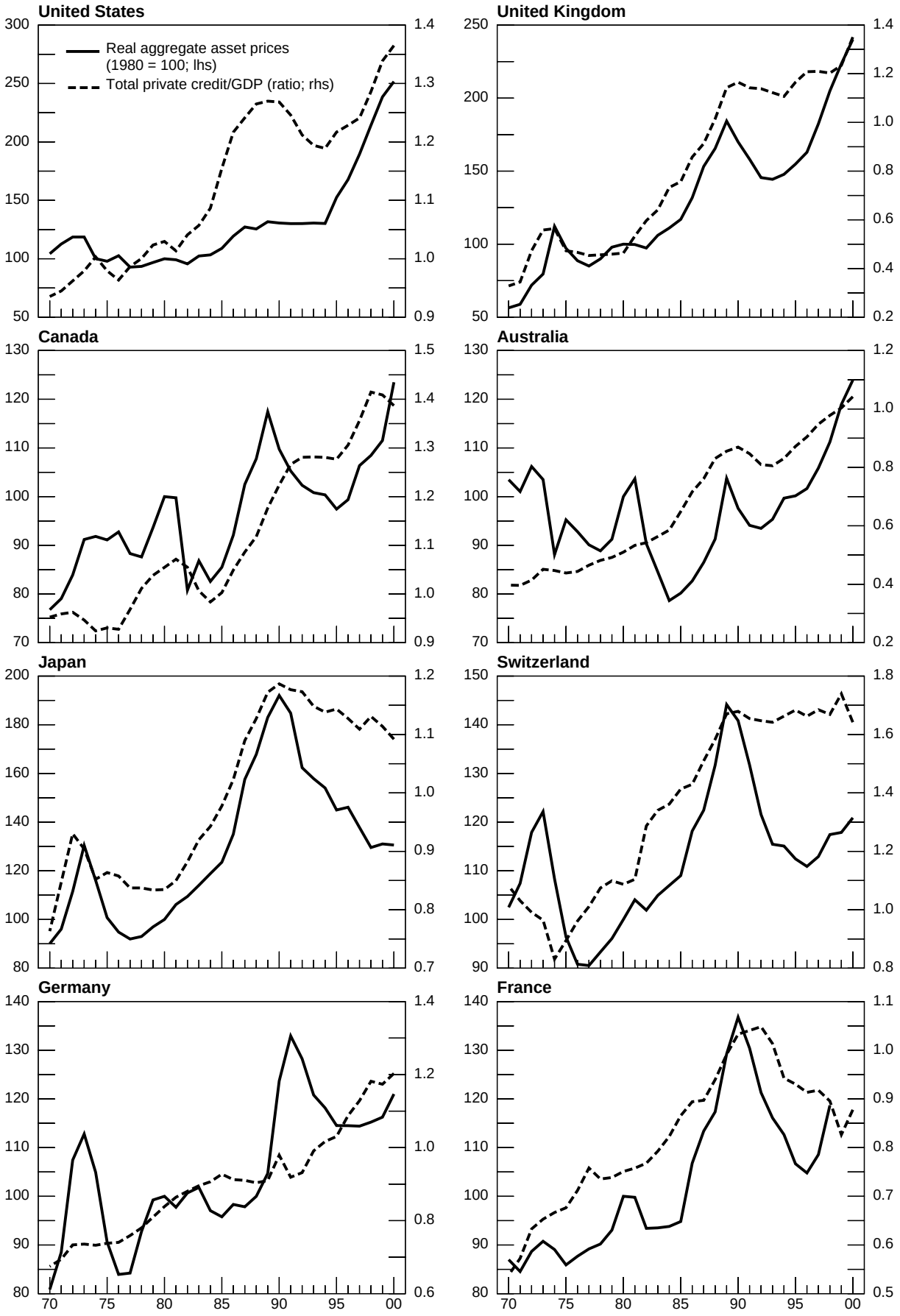
[10] For a discussion of the Australian banking crisis of 1893 see Fisher and Kent (1999).

[11] See Persons (1930) for a detailed account of the rapid credit growth in the United States in the 1920s.

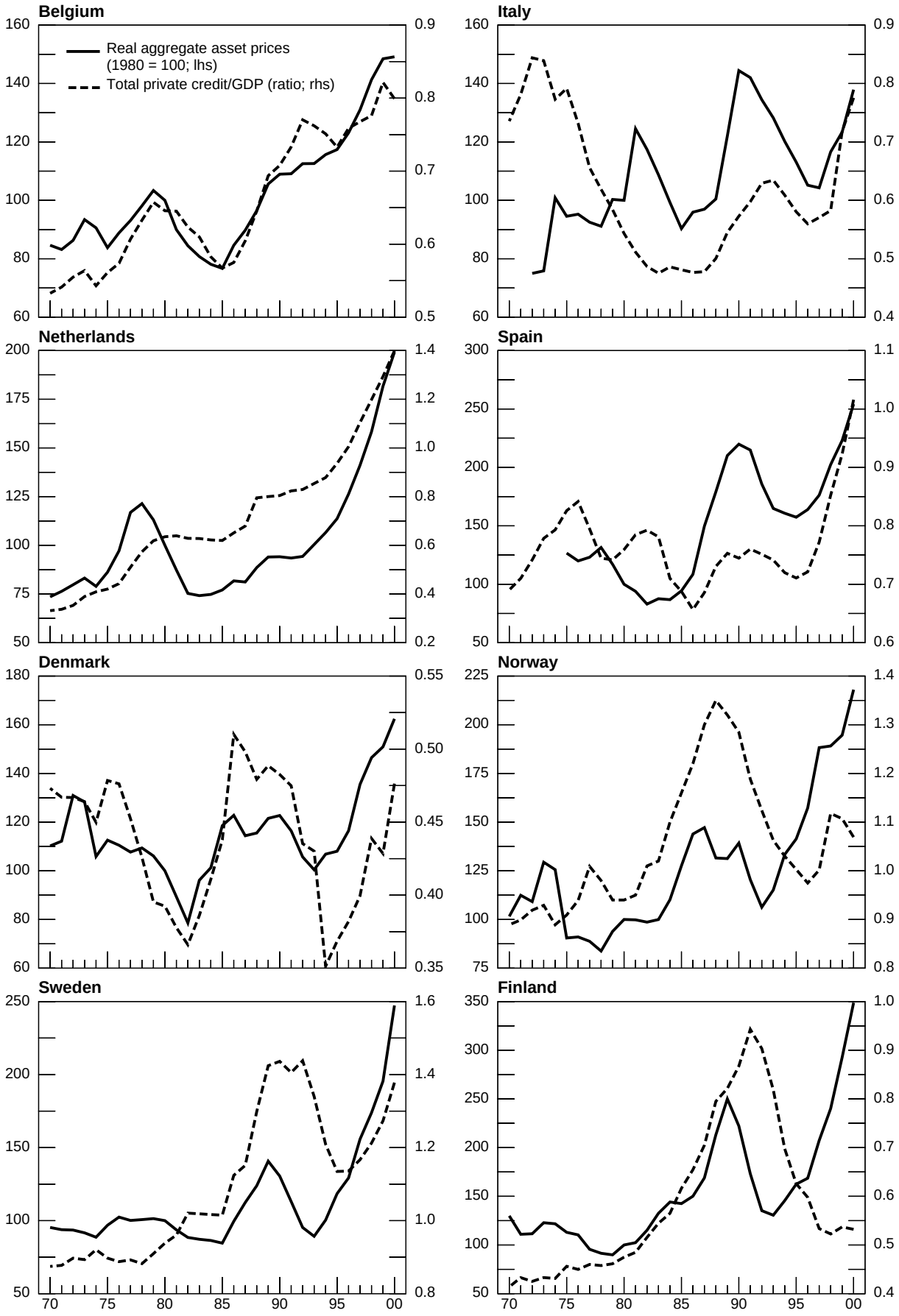
[12] Hutchison and McDill (1999), for example, find that declining stock prices are a useful one-year-ahead indicator of future banking problems. Kaminsky and Reinhart (1999) discover richer dynamics, presenting evidence that equity prices generally fall in the 9 months preceding a crisis and rise strongly in the 9 months before that. Kaminsky and Reinhart do not, however, test for the predictive properties of the original increase and focus on the decline in equity prices. It is unclear from these studies whether the fall in equity prices contributes to the crisis, or simply reflects the market's expectation that a crisis is more likely.

Graph 3

Real aggregate asset prices and credit



Graph 3 (cont)


Belgium
Real aggregate asset prices (1980 = 100; lhs)
Total private credit/GDP (ratio; rhs)
Italy
Netherlands
Spain
Denmark
Norway
Sweden
Finland
70
75
80
85
90
95
00

While asset prices have not generally been considered in these studies, their close cousin – credit – has been subject to considerable empirical investigation. One of the relatively few robust findings to emerge from the literature on leading indicators of banking crisis is that rapid domestic credit growth increases the likelihood of a problem.[13] Typical of the literature is Eichengreen and Arteta's (2000) finding that a 1 percentage point increase in the rate of growth of domestic credit (evaluated at the mean rate of credit growth) increases the probability of banking crisis in the following year by 0.056 percent. Other studies have focused on credit growth lagged two years and find broadly similar effects, at least qualitatively.

Although these results tend to support the notion that booms in credit (and implicitly asset prices) increase the likelihood of financial problems, they provide little, if any, practical guidance about what constellation of outcomes materially increases the potential for instability. This reflects the design of the empirical work as well as the lack of data. Most studies do not take account of cumulative effects, or stocks, instead simply considering the effects of a single year of rapid credit growth, and posit a simple increasing relationship between credit growth in that year and the likelihood of financial problems. Moreover, the interactions between credit, asset prices and the real economy are typically ignored.

One consequence of this is that the existing literature provides relatively little insight into key questions that are of concern to both central banks and supervisory authorities. These include: (i) when should credit growth be judged as "too fast"? (ii) what is the cumulative effect of an extended period of strong credit growth?; and (iii) are lending booms more likely to end in problems if they occur simultaneously with other imbalances, either in the financial system or the real economy?

Beyond bubbles

From a practical perspective the issue of interactions between various imbalances is particularly important. Rapid credit growth, *by itself*, may pose little threat to the stability of the financial system. The same could be said for rapid increases in asset prices or an investment boom. Rather, the historical narratives suggest that it is the *combination* of events, in particular the simultaneous occurrence of rapid credit growth, rapid increases in asset prices and, in some cases, high levels of investment – rather than any one of these alone – that increases the likelihood of problems.

For policymakers, therefore, the more relevant issue is not whether a "bubble" exists in a given asset price, but rather what *combination* of events in the financial and real sectors exposes the financial system to a materially increased level of risk. While the bubble question is intrinsically interesting, it is extremely difficult to answer. Moreover, even if the authorities were confident in their judgement, serious political economy problems are likely if policy responses are explicitly conditioned on that judgement. Instead, a more constructive focus is likely to be on an overall assessment of the risks facing the financial system. Knowing the answer to the "bubble question" would obviously be helpful here, although it is by no means crucial.

A preliminary statistical analysis

Ideally, we would like to construct an accurate index of financial sector vulnerability that takes account of the interactions between all the relevant variables. In practice, this is extremely difficult (and perhaps even impossible) to do. Rather, in this paper our less ambitious goal is to undertake a preliminary investigation into the usefulness of credit, asset prices and investment as predictors of future problems in the financial system. Our intention is to be as parsimonious as possible and to explore how far a few key variables can take us. We are particularly interested in two questions. First, can useful indicators be constructed using only information available to the policymaker at the time that the policy decision is made? And second, can signals be made more accurate by *jointly* considering asset prices, credit and investment?

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[13] See, for example, Dermirguc-Kunt and Detragiache (1997, 1998), Gourinchas, Valdes and Landerretche (2001), Hardy and Pazarbasioglu (1999), Hutchinson and McDill (1999), Kaminsky (1999) and Kaminsky and Reinhart (2000). Bell and Pain (2000) and Eichengreen and Arteta (2000) provide useful overviews of the literature.

Our approach builds on the work of Kaminsky and Reinhart (1999). In particular, we examine whether the occurrence of a boom in asset prices, credit or investment provides a useful signal that a financial crisis is imminent. As in Kaminsky and Reinhart, the idea is to define a threshold value for each of the relevant indicator series. When the indicator takes a value that exceeds the threshold value, we define this as a "boom" and it is said to signal an impending crisis. We examine how the usefulness of the signals changes as we change the threshold values.

Our approach, however, differs from Kaminsky and Reinhart's in a number of respects.

i. We focus on *cumulative processes*, rather than growth rates over just one year. Vulnerabilities are generally built up over an extended period, rather than in a single year. To capture this idea, we identify a credit boom as a period in which the ratio of credit to GDP deviates from its trend by a specified amount (we refer to this deviation as the "credit gap"). A large gap could develop through either one year of very rapid credit growth, or alternatively as the result of a number of years of above trend growth. Similarly, we define asset price and investment booms as periods in which real asset prices and the ratio of investment to GDP respectively deviate from their trends by specified amounts. Again, we refer to these deviations as the "asset price gap" and "investment gap" respectively.

ii. We use *only ex ante information* in determining whether a boom exists. Our approach is to calculate the various gaps using only information that would have been available to the policymaker at the time that he/she was making an assessment of whether or not a boom existed. Accordingly, a rolling Hodrick-Prescott filter is used to estimate the gaps; for example, the credit gap for 1985 is estimated only using data up until 1985. One important consequence of this approach is that the threshold values that define the existence of a boom need to be determined without reference to the entire history of the relevant series.[14] To do this, we simply define the thresholds in terms of percentage (or percentage point) gaps. One advantage of this approach is that it leads to threshold values that are easier to interpret than those used by Kaminsky and Reinhart.

iii. We consider *combinations of indicators*, rather than just single indicators. In particular, we examine what combinations of the credit, asset price and investment gaps provide the most useful signals. In contrast, the approach used by Kaminsky and Reinhart to examine multiple indicators involves simply tallying the proportion of indicators that are "on" at any point in time. Our approach allows us to search over various combinations to determine to what degree the optimal threshold values change as we consider multiple indicators.

iv. We consider *multiple horizons*. In general, it is extremely difficult to predict the timing of a crisis, even if one is almost certain that one will occur. Accordingly, we consider the usefulness of the indicators in predicting crises within one, two and three years respectively.

We intentionally restrict the list of countries that we consider to a relatively homogeneous set given that the factors that underlie financial crises in very poor countries, or those with very repressed financial sectors, might differ from those that cause problems in more wealthy countries with developed financial systems. Accordingly, the list of countries is limited to those that had a ratio of credit to GDP in excess of 35 percent at some point between 1960 and 1999; had GDP per capita in 1995 in excess of US$ 4 000 (at PPP exchange rates) and had total GDP in 1995 in excess of US$ 20 billion. Moreover, only countries with credit data and an equity price series since at least 1980 were considered. All up, our sample consists of 34 countries, including all the G10.[15]

Annual data from 1960 to 1999 are used. Where adequate data are available, the first observation for the estimated gaps is 1970. In constructing the asset price gap, we are unfortunately restricted to considering only equity prices (in real terms). This is clearly second best, as we would prefer to use indices of real estate prices, particularly given the central role that real estate plays as collateral for bank loans. As noted above, however, such indices are available for only a small group of countries

[14] Kaminsky and Reinhart define the thresholds relative to the percentile of the distribution of the indicator *over the whole sample period*. The chosen percentiles differ across indicators but are constant across countries.

[15] Appendix 1 shows a graph of the credit to GDP ratio for each of the countries. All data used in this section of the paper have been obtained from the IFS and national sources. In some cases, adjustments to the credit data have been made to take account of breaks in the series. All data are available from the authors upon request.

and even then do not go back sufficiently far in time to construct meaningful ex ante measures of the asset price gap for most of the years in the 1980s.

In determining the crisis dates we have used Bordo's et al (2001) dating, rather than specifying the dates ourselves.[16] This has both benefits and costs. On the benefit's side, these dates are representative of those used elsewhere in the literature. On the cost's side, they exclude episodes characterised by strong financial headwinds, but not significant failures of banks. For example, the early 1990s is not recorded as a crisis episode for the United States, nor is it for the United Kingdom.[17] While these periods of financial headwinds may not fit the narrow definition of a "crisis", they were certainty characterised by significant macroeconomic costs arising from developments in the financial system and arguably should be included as crisis episodes. In future work, we hope to extend our analysis to consider periods of "financial stress" and not just financial crises, since in practice the distinction between the two is often relatively small.

To start with, Table 1 reports our basic results for the indicators – i.e. the asset price, credit and investment gaps – taken *individually*, and using horizons of 1, 2 and 3 years.[18] For each indicator, the table shows a range of relevant threshold values and the associated noise to signal ratio for each of these values.[19,20] The share of actual crises correctly signalled is also reported. For comparative purposes we also report results for a credit boom defined using just the annual rate of real credit growth.

A number of points emerge from this table.

- Of the indicators examined, the credit gap is clearly the best; it has the lowest noise to signal ratio and correctly predicts the largest number of crises. A threshold value around 4 percentage points appears to produce the best results. Using this value, almost 80 percent of crises are predicted at a one-year horizon, while false positive signals are issued around 18 percent of the time. Using slightly higher threshold values leads to a noticeable reduction in the share of crisis correctly predicted with no, or little reduction, in the noise to signal ratio.
- Taking account of cumulative processes (in this case through the credit gap) yields better indicators than considering just developments over one year. In particular, when comparing the credit gap and the real credit growth indicators, the credit gap produces a lower noise to signal ratio for a given percentage of crises correctly predicted.[21]

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16 Where the crisis episodes extend over multiple years we consider just the first year. In all there are 38 crisis episodes between 1970 and 1999 spread across 27 of the 34 countries.

17 The only crisis for the United States is in 1984 and is associated with problems in the Savings and Loans institutions.

18 For the asset price indicator we introduce a lead of two years; i.e. when measuring whether the asset price gap exceeds a particular threshold we use the level of the equity price gap two years earlier. We do this for two reasons. First, previous studies have shown that equity markets provide a reasonable leading indicator of economic activity and financial problems, with the lead generally being around one to two years. Second, in many episodes a boom in property markets follows a boom in the equity market with a lag of a couple of years. In the absence of data on property prices, introducing a lead on the equity prices gap may allow equity prices to serve as a proxy (at least in some cases) for property prices.

19 In all three cases an indicator is judged to successfully signal a crisis if it is "on" also in the year of the crisis. The justification for doing this is that we are using annual data and we cannot distinguish when in the year the crisis occurs and when in the year the indicator goes "on". (Kaminsky and Reinhart, using monthly data, record a signal as good if a crisis occurs up to one year *prior* to the signal going on). From a policy perspective, one difficulty with this approach is that remedial action cannot be taken if the signal goes only on at the time that the crisis occurs.

20 The noise to signal ratio is defined as the ratio of size of Type II errors (i.e. the percentage of non-crisis periods in which a crisis is incorrectly signalled) to one minus the size of Type I errors (i.e. the percentage of crises that are not correctly predicted). Edison (2000) provides an easy to follow exposition. Where an indicator has been "on" prior to (or at the time of) the crisis and remains on after the beginning of the crisis for either 1 or 2 years we exclude the signals in the years after the crisis from the "noise" calculation (as they are not really false signals).

21 Moreover, if we define the threshold for real credit growth in terms of the *percentile* of the distribution *over the whole sample* (as do Kaminsky and Reinhart) the noise to signal ratio for a given share of crises predicted is *even higher* than when the threshold is defined in terms of an (arbitrarily high) absolute growth rate. This suggests that what is important is the *absolute* growth rate, not the growth rate relative to historical experience. In other words, if the growth rate in a country is generally moderate, the top percentile would be a poor indicator of strains.

Table 1: Performance of indicators

A. Horizon = 1 year

Indicator*											
Asset price gap			Credit gap			Investment gap			Real credit growth		
threshold	noise / signal	% predicted	threshold	noise / signal	% predicted	threshold	noise / signal	% predicted	threshold	noise / signal	% predicted
20	.56	53	3	.29	79	2	.57	58	7	.54	74
30	.44	50	4	.24	79	3	.54	55	8	.47	74
40	.32	50	5	.25	63	4	.50	50	9	.44	68
50	.29	45	6	.25	55	5	.52	42	10	.39	68
60	.29	34	7	.20	55	6	.61	32	11	.36	66
70	.30	24	8	.20	47	7	.55	29	12	.33	66
80	.27	21	9	.18	45	8	.54	26	13	.30	63
90	.43	11	10	.18	37	9	.44	26	14	.30	53

B. Horizon = 2 years

Indicator*											
Asset price gap			Credit gap			Investment gap			Real credit growth		
threshold	noise / signal	% predicted	threshold	noise / signal	% predicted	threshold	noise / signal	% predicted	threshold	noise / signal	% predicted
20	.40	68	3	.27	79	2	.43	71	7	.43	87
30	.32	63	4	.21	79	3	.42	66	8	.38	84
40	.23	63	5	.20	71	4	.42	55	9	.36	79
50	.20	58	6	.19	63	5	.43	47	10	.31	79
60	.18	47	7	.15	63	6	.42	42	11	.29	74
70	.15	39	8	.16	53	7	.40	37	12	.27	74
80	.17	29	9	.14	50	8	.35	37	13	.25	71
90	.18	21	10	.14	39	9	.29	37	14	.22	66

C. Horizon = 3 years

Indicator*											
Asset price gap			Credit gap			Investment gap			Real credit growth		
threshold	noise / signal	% predicted	threshold	noise / signal	% predicted	threshold	noise / signal	% predicted	threshold	noise / signal	% predicted
20	.37	71	3	.25	79	2	.37	79	7	.39	89
30	.28	68	4	.20	79	3	.36	74	8	.35	87
40	.19	68	5	.17	74	4	.40	55	9	.31	84
50	.16	66	6	.16	66	5	.41	47	10	.27	84
60	.13	55	7	.13	63	6	.37	45	11	.24	82
70	.12	45	8	.12	58	7	.33	42	12	.23	82
80	.13	.34	9	.10	55	8	.29	42	13	.20	79
90	.14	.26	10	.11	45	9	.23	.42	14	.18	74

*. The threshold values for the credit gap are defined in terms of the deviation in *percentage points* of the actual credit ratio from the trend ratio. For the other two gaps, the threshold values are expressed as *percentage* deviations from the trend.

- The asset price and investment gaps provide relatively noisy signals at the one-year horizon. For asset prices a threshold value of 40 or 50 percent appears to produce the best results. Using the 40 percent threshold, half the crises are predicted with a one-year horizon, and false positive signals are issued 15 percent of the time. For the investment gap, small threshold values appear to produce the best results, as increasing the threshold value above 4 or 5 percent does not lead systematically to a reduction in the noise to signal ratio but it does reduce the share of crises successfully predicted. Using a 5 percent threshold, 42 percent of crises are predicted at the one-year horizon and false positive signals are issued 21 percent of the time.
- The performance of the indicators improves considerably as the time horizon is lengthened. This improvement is most noticeable for the asset price and credit gaps. For example, if we extend the horizon from one year to three years and use a 4 percentage point threshold for the credit gap, the number of false positive signals falls by around 20 percent. For the asset price gap, the reduction is even larger and the share of crisis predicted also increases as the horizon is lengthened.

Next we examine combinations of indicators. We look at three particular combinations: (i) credit and asset prices; (ii) credit and investment; and (iii) credit, asset prices and investment. In each case a crisis is signalled if both (all) gaps are beyond the specified threshold levels. As above, we consider a range of possible threshold values.

Selected results for the one-year horizon for the first two combinations are reported in Table 2.[22] In both cases, the noise to signal ratio is lower than when the indicators are considered separately. This is particularly so when credit is combined with asset prices. Overall, we judge that a credit gap of around 4 percentage points **and** an asset price gap of 40 percent provide the best combined threshold values. For these values the noise to signal ratio is almost 50 percent lower than the ratio when the signal is activated by a credit gap (of 4 percentage points) alone. Furthermore, as can be seen in Table 3, the noise to signal ratio falls considerably further when the horizon is lengthened to 3 years. Again the decline in the ratio is larger for the combined indicator than for the credit gap alone.

The reduction in the noise to signal ratio obtained by combining indicators arises from a significant reduction in the number of false positive signals. Using our preferred threshold values the number of false positive signals at the one-year horizon falls by almost 75 percent when asset prices are added to credit (at the 3-year horizon the fall is 80 percent). As a result, false positive signals are issued less than 5 percent of the time.

This reduction in noise, however, comes at the cost of a reduction in the share of crises correctly predicted. For example, when we use our combined threshold values of 4 percentage points and 40 percent, we predict 42 percent of crises, compared to 79 percent when we use credit growth alone. This decline largely comes about because when we combine the indicators we miss a number of the crises in South East Asia in the mid/late 1990s and in Latin America in the late 1970s. In these episodes, booming equity markets do not appear to be a central part of the story, although the narratives of these episodes typically attribute an important role to real estate prices. As we have already noted a lack of data makes it impossible to confirm this in this type of empirical study.

We now add investment to the picture so that a crisis is signalled only if the credit, asset price and investment gaps all exceed their threshold values. Selected results are reported in Table 4.

The best combination appears to be for a credit gap of 4 percentage points, an asset price gap of 40 percent and an investment gap of zero. While adding investment leads to a marginal drop in the noise to signal ratio, it also leads to a reduction in the number of crisis correctly predicted. On balance, we judge that adding investment in this way makes no significant improvement.

[22] Results for the two- and three-year horizons are reported in Appendix 2.

Table 2: Performance of joint indicators – one-year horizon

Asset prices and credit*				Investment and credit*			
threshold for credit gap	threshold for asset price gap	noise / signal	% predicted	threshold for credit gap	threshold for investment gap	noise / signal	% predicted
4	30	.17	42	4	1	.25	45
4	40	.13	42	4	2	.24	42
4	50	.12	39	4	3	.23	42
4	60	.11	29	4	4	.20	39
5	30	.16	37	5	1	.25	39
5	40	.12	37	5	2	.25	37
5	50	.12	34	5	3	.23	37
5	60	.12	24	5	4	.20	34
6	30	.17	32	6	1	.25	34
6	40	.13	32	6	2	.25	32
6	50	.13	29	6	3	.23	32
6	60	.11	24	6	4	.21	29
7	30	.15	32	7	1	.21	34
7	40	.13	29	7	2	.21	32
7	50	.13	26	7	3	.19	32
7	60	.10	24	7	4	.19	26

*. The threshold values for the credit gap are defined in terms of the deviation in *percentage points* of the actual credit ratio from the trend ratio. For the other two gaps, the threshold values are expressed as *percentage* deviations from the trend.

Table 3: Performance of joint indicators at different horizons

Horizon (years)	Threshold: Credit gap = 4 %points		Threshold: Credit gap = 4 %points AND Asset price gap = 40 per cent	
	noise / signal	% predicted	noise / signal	% predicted
1	.24	79	.13	42
2	.21	79	.08	53
3	.20	79	.06	55

Table 4: Performance of the three indicators combined

Asset prices, credit and investment*									
threshold for credit gap	threshold for asset price gap	threshold for investment gap	noise / signal	% predicted	threshold for credit gap	threshold for asset price gap	threshold for investment gap	noise / signal	% predicted
4	30	0	.15	34	5	30	0	.15	29
4	30	1	.16	32	5	30	1	.17	26
4	30	2	.15	29	5	30	2	.17	24
4	30	3	.15	26	5	30	3	.17	21
4	30	4	.13	24	5	30	4	.15	18
4	40	0	.12	34	5	40	0	.12	29
4	40	1	.13	32	5	40	1	.13	26
4	40	2	.13	29	5	40	2	.13	24
4	40	3	.12	26	5	40	3	.14	21
4	40	4	.11	24	5	40	4	.12	18
4	50	0	.11	32	5	50	0	.12	26
4	50	1	.12	29	5	50	1	.13	24
4	50	2	.12	26	5	50	2	.13	21
4	50	3	.12	24	5	50	3	.14	18
4	50	4	.10	21	5	50	4	.12	16

*. The threshold values for the credit gap are defined in terms of the deviation in *percentage points* of the actual credit ratio from the trend ratio. For the other two gaps, the threshold values are expressed as *percentage* deviations from the trend.

Overall, while this empirical exercise is meant as no more than a first step in exploring the factors that increase the vulnerability of the financial system, it does provide reasonably strong circumstantial evidence that useful ex ante indicators of financial vulnerability can be constructed. The results confirm that, at a minimum, indicators of vulnerability should take into account cumulative processes and pay particular attention to the interaction of asset prices and credit. While we would not like to place too much weight on the precise threshold values, the results do suggest that an economy in which the credit gap is above 4 or 5 percentage points and asset prices are 40 or 50 percent above trend is more than usually vulnerable to problems in the financial system.

One general issue raised by these results is the trade off between Type I and Type II errors. Ideally, what we are searching for are combinations of indicators that reduce the noisiness of the signal, while at the same time maintaining the share of crises actually predicted. In practice, what we find is that by combining indicators we can significantly reduce the noise (i.e. reduce Type II errors), but we miss a larger number of crises (i.e. increase Type I errors). From a policy perspective, a relevant issue is whether it is a bigger error to fail to respond to emerging vulnerabilities, or to mistakenly respond to incorrect signs of future problems.

The correct answer inevitably depends upon the particular circumstances and the nature of the policy response. One argument is that, in a relative sense, prudential supervisors might care less about Type II errors than would monetary authorities, particularly those with inflation targets. The reason is partly a political economy one (although as we discuss below there may be economic reasons as well). If a central bank with an inflation target tightened monetary policy in an effort to contain what it thought were financial imbalances, and it later turned out that no imbalances existed, the bank is likely to come under heavy criticism for deviating from its normal policy approach. If this is the case, it might want to be almost certain before it acted. In contrast, it is arguable that a tightening of prudential standards when in reality none was needed may provoke less criticism, and so prudential authorities might be prepared to act with less strong evidence. As we argue below, however, this situation could change with the adoption of an alternative monetary policy regime under which it was understood that monetary policy had a role to play in preserving financial stability over and above keeping inflation

under control in the short run.[23] It is to this issue of the interaction of financial and monetary stability that we now turn.

4. From monetary stability to financial stability?

In the discussion so far we have not addressed the all-important link between monetary and financial stability. Two broad interrelated questions are of particular interest. First, to what extent does monetary stability – which we interpret here as meaning low and stable inflation – contribute to financial stability? Second, what type of monetary policy regime is likely to deliver the ideal combination of monetary *and* financial stability?

The conventional wisdom

The conventional wisdom on the links between monetary and financial stability is nicely summarised by Bordo et al (2000) who write "that a monetary regime that produces aggregate price stability will, as a by-product, tend to promote stability of the financial system" (p 27).

As a general point, few would disagree with this statement, particularly the idea that volatility in the inflation rate can harm the stability of the financial system. An unexpected decline in inflation increases the real value of outstanding debt, making defaults more likely. Accordingly, periods of declining inflation, particularly if they are associated with restrictive monetary or fiscal policies, are more likely to see stresses in the financial system than are periods with stable inflation. Similarly, the vulnerability of the financial system measured over the horizon of a couple of years tends to rise when inflation is higher than expected, particularly if macroeconomic policies need to be tightened significantly to reduce inflation. Furthermore, high inflation, even if it is relatively stable, can pose a threat to financial stability, particularly if it encourages leveraged asset acquisitions and the misallocation of resources.[24]

There is some empirical work to support these ideas. For example, Hardy and Pazarbasioglu (1999) find that an increase in inflation, followed by a sharp reduction, significantly increases the probability of a financial crisis, while Demirguc-Kunt and Detragiache (1997) find that countries with high levels of current inflation are more likely to experience a financial crisis. Similarly, Bordo et al (2000) argue that episodes of financial distress in the United States in the 18th and 19th centuries generally took place in a disinflationary environment following several years of inflation.[25]

Beyond the conventional wisdom

While the empirical evidence is broadly consistent with the idea that monetary instability can cause financial instability, the interpretation of this evidence, and the policy conclusions that follow, are arguably subtler than is sometimes recognised. In particular, the evidence does not mean that either: (a) unexpected changes in the inflation rate are by themselves a major source of financial instability, or that (b) financial vulnerabilities will not develop in a low and stable inflation environment.

Bordo et al (2000), for example, interpret the evidence as suggesting that the only contribution that monetary policy can make to financial stability is through avoiding unanticipated changes in prices, and that the cause of any anticipated price change is unimportant.[26] Such a strong conclusion seems

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[23] See also the discussion in Lowe (2001).

[24] Schwartz (1995) argues that high inflation contributes to unproductive lending as it exacerbates information asymmetries making it more difficult for lenders to assess the true riskiness of potential borrowers. Furthermore, it could be argued that the demand for real estate tends to increase in high inflation environments given that real estate provides a reasonable hedge against inflation. Moreover, many tax systems contribute to the attractiveness of leveraged asset purchases when inflation is high.

[25] See also Bordo and Wheelock (1998).

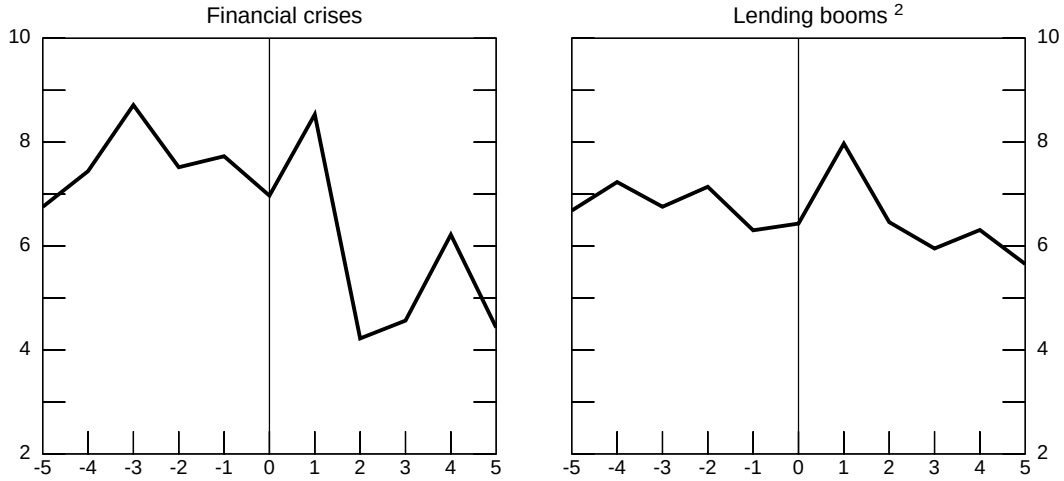
[26] Specifically, they write "Similarly, the contribution of aggregate price stability to the stability of the financial system depends neither on the cause of specific price level movements nor on the nature of the monetary regime, except insofar as they affect the extent that changes in aggregate prices are anticipated." (p 7)

difficult to justify. In general, it is not the unanticipated decline in goods and services price inflation *per se* which causes financial problems. Rather, it is the decline in asset prices and the unwinding of financial imbalances built up in previous years that largely explains the onset of a crisis.[27] In many cases the fall in inflation that can occur around the time of the crisis is part of the process of the unwinding of the previous excesses, and is not itself the main cause of the crisis. Moreover, in episodes where inflation has fallen unexpectedly (perhaps due to a positive supply shock) but that have not been characterised by the unwinding of imbalances, the financial system has typically not come under significant strain. The experience of the unexpected decline in inflation in many countries in 1986 and 1987 due to the fall in oil prices is perhaps an example. To reiterate the central point: *it is the unwinding of financial imbalances that is the major source of financial instability, not an unanticipated decline in inflation per se*.[28] Often the two will go together, but they need not!

A corollary of this point is that while low and stable inflation promotes financial stability, financial imbalances can still build up without any noticeable pick up in inflation. This can be seen in Graph 4, which shows the evolution of the average inflation in the years prior to, and after, the crises examined in Section 3 (also shown is the average inflation rate around the time of lending booms). While, on average, inflation falls immediately after the crisis, there is no evidence that inflation picks up systematically either in the years prior to the crisis or as lending booms are developing.

Graph 4

Behaviour of inflation around financial crises and lending booms [1]



[1] Simple arithmetic means of annual percentage changes of consumer prices across all countries (except Latin America). [2] Defined as year in which the credit/GDP gap (first) exceeds 4 percentage points; ex-ante HP filter applied.

The best example, at least over recent times, of financial imbalances developing in a low inflation environment is Japan in the late 1980s. In 1986, 1987 and 1988 CPI inflation was essentially zero (see Graph 5). It was not until mid 1989 that evidence of an increase in inflation emerged, and even then inflation measured using the CPI peaked at only 3.9 towards the end of 1990 (measured using the GDP deflator the peak was just 3.0 percent). In contrast, stock prices nearly tripled between the end of 1985 and mid 1989, with commercial property prices in Tokyo increasing by even more.

While the Japanese experience in the 1980s is unusual, there are other examples of imbalances developing during periods of low or declining inflation. In South Korea, for example, inflation was generally falling throughout the 1990s, declining from a peak of over 11 percent early in the decade, to

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[27] The unwinding could, but need not, be associated with a prior tightening of monetary policy.

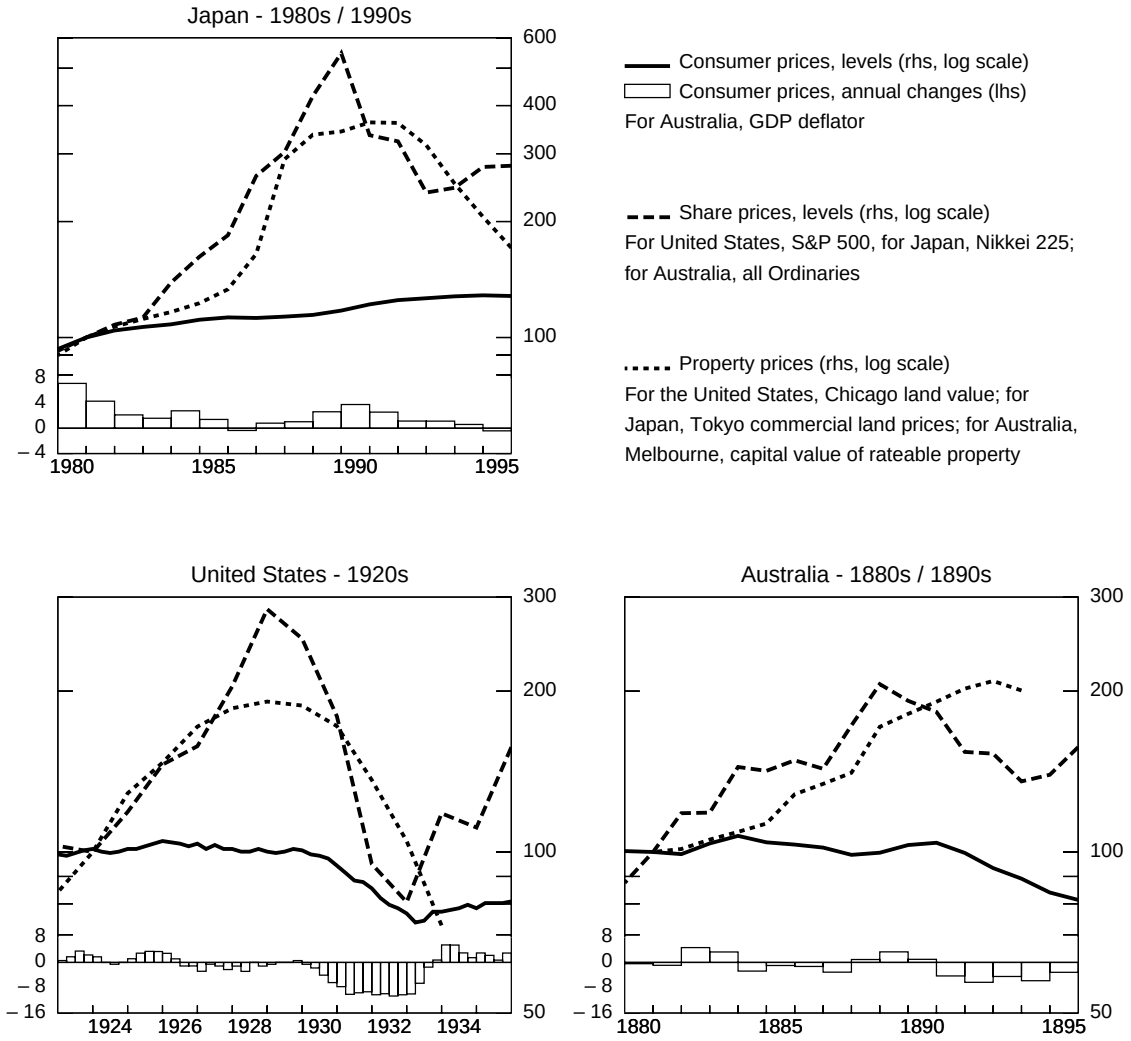
[28] This is not to deny, of course, as first emphasised by Fisher (1931), that ceteris paribus deflation can contribute to financial instability, by increasing the value of real debts. But the *context* in which that is occurring, i.e. exogenous improvements in productivity and profits versus depressed demand conditions and declines in asset values, is critical. On this, see also Selgin (1997).

under 4 percent just before the crisis. Elsewhere in Asia, inflation was also relatively low, and tending to decline, prior to the crisis in 1997, yet asset prices and credit were rising strongly.

These experiences are, of course, not new. In the United States, the CPI actually fell by 10 percent between 1925 and 1930, while credit and stock prices boomed. In the 19th century too, banking crises often developed in low inflation environments. One example is the Australian banking crisis of 1893, which occurred after a frantic property boom in the 1880s.[29] This boom saw the ratio of bank credit to GDP rise by an estimated two thirds over decade prior to 1893. Property prices in Melbourne and Sydney doubled at least over the same period, with particularly large increases recorded in the late 1880s. In contrast, the GDP deflator actually fell over the decade before the crisis, with the largest increase in any single year being less than 5 percent.

Graph 5

Consumer and asset prices for selected countries and periods



Note: For level series, Japan 1980 = 100, United States, 1923 = 100, Australia 1880 = 100.

Sources: For property prices: Tokyo, National Land Agency and local governments; Chicago, Hoyt (1933); Melbourne, Kent and D'Arcy (2001); for equity and consumer prices, B.Taylor - 'Global Financial Data' (database), Los Angeles and national data.

[29] See Fisher and Kent (1999) and Kent and D'Arcy (2001) for accounts of this and other credit cycles in Australia.

The co-existence of an unsustainable boom in credit and asset markets on the one hand, and low and declining inflation on the other, can be explained by a number of factors or events.[30]

The *first* of these is the successful implementation of a stabilisation program. This factor has been important in the development of financial imbalances in developing countries, particularly in Latin America in the late 1970s. The implementation of a credible stabilisation program that anchors price expectations (through perhaps a controlled deprecation of the exchange rate) can lead to a significant and immediate reduction in inflation. This reduction can generate optimism about future economic prospects, which, together with financial liberalisation, can underpin a consumption and lending boom (often financed by inflow of foreign capital). In response, asset prices, particularly real estate prices, typically rise further reinforcing the credit boom. Although inflation remains low, the poor lending decisions made during the credit boom sow the seeds for future problems. These problems can be compounded if the process of disinflation leads to a gradual appreciation of the real exchange rate.[31]

A *second* factor that can result in subdued inflation and the development of financial imbalances is an improvement in the supply side of the economy; for example, a pick up in the pace of technological advancement or reform of the labour market. Such developments can put upward pressure on asset prices, not only because of their positive effect on current levels of corporate profitability, but also because of the sense of general optimism about the future that they typically generate. Simultaneously, they can put downward pressure on the prices of goods and services, particularly by reducing unit labour costs. The Bank of Japan, for instance, has argued that faster productivity growth and shifts in the structure of the labour market were partly responsible for the low inflation rates of the 1980s.[32] A decade later, a pick-up in the rate of productivity growth in a number of countries, most notably in the United States, has also been used to explain the benign inflation outcomes of the late 1990s and the strength of many equity markets.

The combination of rising asset prices, strong economic growth and low inflation can lead to overly optimistic expectations of the future in a similar vein to the overly optimistic expectation that can follow a stabilisation program.[33] In turn, these expectations can generate increases in asset and credit markets significantly beyond those justified by the original improvement in productivity. A self-reinforcing boom can then emerge, with increases in asset prices supporting stronger demand and sustaining, at least for a while, the optimistic expectations of the future. While the stronger demand can put upward pressure on inflation, this pressure can be masked by the improvements to the supply side of the economy.

A *third*, and subtler factor, is the existence of a high degree of monetary policy credibility. Where credibility is high, inflation expectations tend to become well-anchored and long-term price and wage contracting becomes more frequent. These endogenous responses to credible monetary policy may make the inflation rate less sensitive, at least for a period of time, to demand pressures in the economy.[34] During periods of strong demand growth, this cost and price stickiness can boost profits, particularly if firms are operating with excess capacity or under increasing returns to scale. At the same time, highly credible monetary policy can reduce the degree of uncertainty that people feel about the future. In particular, a successful record by the central bank may well reduce the probability that the public assign to the occurrence of a sustained economic downturn. Lower uncertainty can then translate into higher asset prices and an increased willingness of investors to borrow, and financial institutions to lend. These responses can ultimately make the financial system more vulnerable to an economic downturn.

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30 One additional factor not discussed below arises from the Modigliani-Cohn (1979) effect. When inflation declines the change in accounting profits tends to overstate the change in economic profits as the lower nominal interest rates that eventually accompany lower inflation lead to a reduction in interest servicing costs (even if real interest rates remain unchanged). If investors fail to recognise this effect, equity prices are likely to be bid up, and in some circumstances this rise in prices may be the catalyst for an unsustainable boom. On the empirical significance of this, see McCauley et al (1999).

31 Much of the literature on the ultimate failure of these type of stabilisation schemes focuses on the lack of credibility of the stabilisation program; see for example the discussion in Calvo and Végh (1999). Arguably, however, the imbalances built up in the financial system in the initial phase of the program are driven not by a lack of credibility, but by the combination of deregulation and too much initial confidence that the program will succeed.

32 See, for example, the discussion in Yamaguchi (1999).

33 See Borio et al (2001) for a detailed discussion of possible reasons why this occurs.

34 On this see Goodfriend (2000).

The *fourth* and related reason is that low and possibly falling inflation together with a high degree of credibility of monetary policy would give little reason for the authorities to tighten policy if they respond *only* to clear signs of inflationary pressures. Paradoxically, these endogenous responses to credible monetary policy increase the probability that latent inflation pressures manifest themselves in the development of imbalances in the financial system, rather than immediate upward pressure on higher goods and services price inflation. Failure to respond to these imbalances, either using monetary policy or another policy instrument, may ultimately increase the risk of both financial instability and subsequently deflation (during the period in which the imbalances are unwound). The implication of this is that central banks with a high degree of credibility need to remain alert to the possibility that inflationary pressures first become evident in asset markets, rather than goods markets.

5. Policy challenges[35]

The question for monetary authorities

The possibility of financial vulnerabilities developing during a low inflation period raises interesting issues about the design of monetary policy frameworks. Of particular interest is the question of what type of monetary regime is most likely to deliver the "best" combination of monetary and financial stability. More concretely, is a monetary regime focused exclusively on controlling short-run deviations of inflation around some desired average level likely to deliver the right combination of monetary and financial stability?

This is a difficult question, particularly given the relatively short period over which inflation-targeting regimes have been in operation. While there are solid reasons to believe that such regimes will, as a by-product, promote financial stability, there are risks as well. Most notably, such regimes might fail to respond in a sufficiently timely manner to emerging threats to the financial system, particularly if these develop during a period of subdued inflation pressures.

If the risk of this occurring is significant, then a slightly modified policy regime, under which the central bank responds not only to short-term inflation pressures but also, at least occasionally, to financial imbalances, may ultimately deliver a better combination of monetary and financial stability. Under such a regime the central bank might opt for higher interest rates than are justified simply on the basis of the short-term inflation outlook if there are clear signs of financial imbalances, such as if credit growth is rapid and asset prices are rising quickly. The justification for doing so could be that the higher interest rates could help contain the financial excesses, and in so doing reduce the probability of future financial instability and possibly a sustained undershooting of the inflation objective.

The desirability of such a regime depends upon a range of factors. These include: (i) the ability of the authorities to identify financial imbalances; (ii) the usefulness of other instruments, including prudential policy; (iii) the effectiveness of interest rate increases to contain imbalances; and (iv) the extent to which central bank reactions may create moral hazard.

Before assessing these questions in detail, however, it is worth standing back and casting a bird's-eye view on the historical record of the relationship between monetary and financial stability across regimes in the monetary and financial spheres. This highly stylised representation, a sort of "informed hypothesis", can help to provide some perspective and assess the stakes involved. It can also highlight the role of arrangements in the financial sphere, the other key element in the overall picture and possible policy tool.

[35] The policy dilemmas raised in this section are also addressed in BIS (2001), Chapter 7, Borio and Crockett (2000), Borio et al (2001), and Crockett (2000a), (2000b) and (2001).

Monetary and financial (in)stability across regimes[36]

Under the Gold Standard, one can think of convertibility into gold as acting as the single anchor for monetary and financial stability. Monetary stability was defined in terms of maintenance of convertibility. And this was also the constraint that would typically give way at times of financial instability, when deposits could no longer be turned into gold at par. Few, if any, constraints existed on banks' balance sheets and cross-border financial transactions. The financial system was liberalised. The convertibility constraint was highly visible and explicit. It was not sufficient, however, to prevent waves of widespread financial instability in the wake of excessive credit expansion.[37] [38]

In the inter-war years, the progressive emergence of fiat standards altered the tight link between monetary and financial stability. Monetary stability became increasingly identified with price stability. The acceptance of a currency was now ultimately based on the power of the State to tax. With the domestic currency acting as the basis for the measurement of value and with convertibility of deposits into currency being assured, financial instability was de-coupled from convertibility into gold. At the same time, the new regime made credit fully endogenous, loosening further the constraints on its potential expansion. With initially little change in arrangements in the financial sphere, the system became more vulnerable to financial cycles. Indeed, the major financial instability that followed was a catalyst for the introduction of the strict regulation of commercial banking, including through a variety of liquidity, maturity matching and solvency requirements.[39] A separate anchor was thus put in place in the financial sphere. This anchor, however, went hand in hand with the establishment or major strengthening of safety nets; explicit deposit insurance in the United States is the best-known example. Inadvertently, by weakening financial discipline, safety nets added to the potential for the build up of imbalances.

The Bretton Woods regime quickly developed into a fiat standard coupled with financial repression. The de jure convertibility constraint for official transactions gave way to a de facto dollar standard. At the same time, a complex web of regulations of a prudential and monetary nature (e.g. ceilings on loan growth) heavily constrained balance sheets as well as cross-border and foreign exchange transactions. Regardless of their goal, the end result of these constraints was the same: they limited the scope for financial cycles. Central banks' common tendency to focus on credit also played a similar role. For a while, the system did deliver monetary and financial stability, but at increasing costs in terms of resource allocation.

Eventually these costs lead governments to deregulate, which saw relaxation of the self-imposed and exogenous constraints in both the monetary and financial spheres. Greater willingness to use money to finance deteriorating fiscal positions and increasingly ambitious monetary policies loosened the constraints on credit expansion. Likewise, slowly but surely financial repression began to be rolled back. International financial markets grew in importance in the allocation and generation of credit. Financial instability started to re-emerge, coexisting with rapid inflation. In some quarters this correlation led to the conclusion that inflation *caused* financial instability.

The subsequent phase takes us to the present day. In the monetary sphere, after a protracted battle in the 1980s inflation has been conquered. And arrangements have been put in place to consolidate these gains: most central banks now have clear mandates to maintain price stability and the necessary autonomy to do so. At the same time, financial liberalisation has gathered pace, nationally and internationally. Financial cycles appear to have grown in amplitude. Financial instability has re-emerged as a major policy concern. Since the late 1980s, the authorities have strengthened efforts to upgrade prudential safeguards.

This brief review highlights three points.

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[36] This subsection draws heavily on Borio and Crockett (2000) and Crockett (2000a). See also BIS (1997). Bordo et al (2001) include an historical review of the incidence of financial instability which is broadly consistent with the stylised picture presented here.

[37] A distinction should also be made between individual countries and the system as a whole. For each individual country, especially if not at the very core such as England, the system was equivalent to a hard peg, with countries enjoying no room for independent monetary policy and at the mercy of capital flows.

[38] For a discussion of financial crises prior to 1914 see Goodhart and Delargy (1998) and Eichengreen and Bordo (2001).

[39] See Allen et al (1938) and Giannini (2001).

First, arguably no regime in history has simultaneously achieved sustained monetary and financial stability. The search for appropriate anchors in the monetary and financial sphere has proved elusive. The task ahead should not be underestimated.

Second, financial and monetary stability are inextricably intertwined. To address the policy issues satisfactorily, a consensus is needed, particularly between monetary and prudential authorities, regarding the genesis of, and possible remedies for, financial instability.

Third, one useful way of thinking about the vulnerability of a regime to financial instability is to think of its "*elasticity*". This concept relates to the regime's inherent potential to allow imbalances to build up over time, with forces endogenous to the regime failing to rein them in, until they eventually unwind. This concept focuses on the upswing, when the seeds of the problems are sown, rather than on the downswing, when problems materialise. A regime's elasticity depends on the *conjunction* of arrangements in the monetary and financial spheres. For example, compare the current set of arrangements with the classical Gold Standard. In the financial sphere, prudential regulation reduces the system's elasticity, by constraining over-extension in balance sheets. However, safety nets can work in the opposite direction by increasing moral hazard. In the monetary sphere, the external convertibility constraint imposed under the Gold Standard has been replaced by the reaction function of the monetary authorities that is essentially discretionary. Which of the two regimes is more elastic? The answer presumably depends on the specifics of the arrangements and policy strategies.

A prudential response

The obvious answer to the question of how financial stability should be ensured is to put in place an "appropriate" prudential framework. A "Tinbergenesque" approach would indeed suggest that financial stability should be left to prudential policy while monetary stability should be assigned to monetary policy. Two instruments for two goals.

In an ideal world, this would be the first best. However, as the previous analysis suggests, matters are not so simple. The proposed solution begs two questions. What amounts to an "appropriate" prudential framework? And how close are current and prospective arrangements to this ideal?

One view is that the efforts that have been made since at least the mid 1980s to upgrade prudential safeguards will ultimately be sufficient. Weaknesses in corporate governance, regulation and supervision, disclosure and safety nets have all in the past been important sources of instability. By improving the financial infrastructure, partly through the development of international standards, these sources of instability can be significantly lessened.[40] .

Of course, international standards, even if fully implemented[41], offer no guarantee of financial stability. This leads to an alternative view that sees potential scope for additional measures to deal with financial cycles. This view stresses the mutually reinforcing, heavily procyclical perceptions of risk, the availability of external finance, asset prices and capital accumulation. It points to signs that financial cycles appear, if anything, to be growing in magnitude, even in countries furthest advanced in meeting international standards of best practice. And it notes that it is distortions in perceptions of asset values and risk – the very raw material on which prudential regulation operates – that generate financial instability.

If this latter analysis is correct, what could be done to strengthen the prudential framework? We have argued elsewhere in some detail how the guiding principle would be to strengthen its system-wide ("macroprudential") orientation, notably through policies designed to reduce the procyclical forces within the financial system.[42] One specific goal would be to strengthen defences in good times so that they can be drawn upon in bad times. In principle, a broad spectrum of instruments is available. These include rules (built-in stabilisers) or discretionary adjustments in capital standards, provisions[43],

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[40] See the strategy as formulated in G10 (1997) and the core set of standards available from the Financial Stability Forum website (www.fsforum.org).

[41] Obviously, where these conditions are not met, the burden on monetary policy is greater.

[42] See Borio et al (2001). This point is also discussed in Crockett (2000b).

[43] For an elaboration of policy options regarding provisioning practices, see Borio and Lowe (2001). See also McCauley et al (1999) for other options designed to limit unwelcome credit expansion.

collateral valuations and loan-to-value ratios, greater reliance on stress testing and a heightening of the system-wide focus in assessments of vulnerabilities.[44] As regards these assessments, for instance, refinements of the preliminary work presented in this paper would be just one possible example of the kind of shift we have in mind.

Even so, while it is possible to identify policy options, their implementation is fraught with difficulties. What form would, in practice, any such policies take? How far would they be open to arbitrage at the level of individual institutions and of the system as a whole? To what degree could firms' risk management practices be made consistent with the system-wide perspective called for?

Despite very encouraging steps in recent years, we are still a long way from achieving a greater consensus on the nature of the problem and hence on the possible solutions.[45] Moreover, their implementation would require a shift in the way prudential authorities conceive of their task. Currently, the primary focus is on preventing the failure of *individual* financial institutions, the calibration of instruments is done only with respect to firm-specific risk profiles, and there is a tendency to treat macroeconomic risks as *exogenous* with respect to the institutions' behaviour. It is, for instance, not uncommon for prudential authorities to eschew responsibility for addressing *aggregate* financial imbalances, seen as macroeconomic phenomena that fall under the remit of monetary and fiscal authorities. In addition, several of the remedies would require the co-operation of accounting and tax authorities too; forward-looking provisioning being an obvious example. This further complicates achieving the required consensus.

A monetary response?

We have thus come back full circle. To the extent that the current and prospective prudential framework may not *by itself* guarantee the desired degree of financial stability, the justification for considering monetary policy responses to the build up of financial imbalances is strengthened. Even so, critical questions arise concerning its effectiveness.

Three powerful objections have been levied against the use of monetary policy.[46]

First, the authorities may not be able to identify the financial imbalances sufficiently early and with the required degree of comfort to take remedial action. If so, attempting to respond to financial imbalances could add to the volatility of the economy.

Second, the risk of destabilising the economy may be compounded by the unpredictability of the effect of the policy response. Calibration may be exceedingly difficult. On the one hand, for instance, small interest rate increases may not be sufficient to contain financial excesses. It has even been argued that, paradoxically, they could be counterproductive if they help to dispel doubts about the central bank's credibility as a guarantor of price stability, thereby possibly fuelling market participants' optimism about the sustainability of the boom.[47] On the other hand, large increases could risk tipping the economy into an unnecessary recession.

Third, even if technically possible, any such response may be too hard to justify to the public. Political economy considerations militate against the use of the instrument. It takes a brave central bank to raise interest rates in the absence of obvious inflationary pressures, given the risk of being perceived as undermining prosperity. Moreover, even if the central bank was successful in containing the imbalances, this would necessarily lead to a slowdown in economic growth. In the absence of any evidence to the contrary, the central bank could come under heavy criticism for undermining what many people would have regarded as a strong and sustainable boom.

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[44] Considerable steps have been taken since the Asian crisis to strengthen the systemic focus in the assessment of vulnerabilities. At the international level, the Financial Stability Forum, the Basel-based Committee on the Global Financial System and the IMF have played a leading role. At the national level, central banks have been particularly active, as evidenced by the publication of Financial Stability Reports.

[45] For a useful discussion of possible responses and the associated difficulties see Carmichael and Esho (2001).

[46] For sceptical views concerning the use of monetary policy, see Bernanke and Gertler (1999), Vickers (1999), and some of the points made in CEPR/BIS (1998).

[47] On this see, in particular, Yamaguchi (1999).

Powerful as these objections are, they fall short, in our view, of ruling out a monetary policy response altogether. They arguably over-estimate the difficulties in identifying financial imbalances. They may fail to take sufficient account of the asymmetric nature of the costs associated with policy mistakes. And they ultimately stand or fall on the paradigm used to interpret the forces driving the economy. Consider each point in turn.

The difficulties in *identifying financial imbalances* are artificially magnified when the question is put in terms of *asset price bubbles*. The pitfalls in assessing "fundamental values" are well known. Indeed, it is precisely this observational indeterminacy that facilitates the formation of financial imbalances. When framed in these terms, the debate easily strays into almost ideological territory, unnecessarily pitching supporters and sceptics of "market efficiency" against each other.

The identification difficulties, however, look less daunting when the issue is articulated in terms of the *set of conditions* that are likely to generate significant strains in the financial system. As our preliminary empirical analysis suggests, certain regularities do exist. In particular, periods of strong credit growth, booming asset prices and high levels of investment almost invariably lead to stresses in the financial system. And importantly, as necessary for policy, these regularities can be discerned purely on the basis of ex ante information and pertain to horizons that would not necessarily rule out a monetary response.

Are these regularities sufficiently strong? The statistical analysis in this paper is just a first step in more ways than one. It simply indicates a direction of future work, based on greater attention to conceptual underpinnings (e.g. cumulative vs. marginal processes, specific constellations of conditions vs. individual signals) and to policy requirements (e.g., ex ante vs. ex post information, appropriate horizons). And it is only part of a richer set of information on which the authorities can and do rely to form a judgement about vulnerabilities and risks. On balance, we feel that on purely technical grounds these considerations make at least occasional policy responses viable. Moreover, additional work in this area may well strengthen the case further. After all, compared with the sheer volume of analytical and empirical studies about the inflation process, this field is in its infancy.

The *asymmetric nature of the costs of policy errors* arguably strengthens the previous argument. If the economy is indeed robust and the boom is sustainable, actions by the authorities to restrain the boom are unlikely to derail it altogether. By contrast, failure to act could have much more damaging consequences, as the imbalances unravel.

It may well be true, of course, that the threshold degree of comfort is considerably higher for the monetary than the prudential authorities. This reflects the need to trade off their mandated primary objective (price stability) with financial stability and translates into different perceptions of the costs of Type I and Type II errors, as already discussed. Furthermore, these perceived trade-offs underlie the political economy problems faced in deviating from what are now seen as legitimate policy norms.

The point to emphasise is that the *perceived trade-offs* are themselves to a significant degree a function of what we *think we know about the workings of the economy and the role of policy*. This determines views about the consequences of actions and of failures to act by the central bank. Such views change over time, in the light of evolving circumstances. It was, for instance, the recognition of the absence of a long-run trade-off between inflation and unemployment during the global inflationary phase that laid the basis for the adoption of the current mandates and policy rules.

Might not a subtle paradigm shift be worth considering again? As has the one that has taken place since the 1970s, this shift would have implications for our standard conception of the dynamics of the economy with consequences for policy that would, however, be less far-reaching.

If financial imbalances can build up in an environment of low inflation it stands to reason that a monetary policy reaction function that does not respond to these imbalances when they occur can unwittingly accommodate an unsustainable and disruptive boom in the real economy. The result need not take the form of inflation, although latent inflationary pressures would normally exist. Rather, it would be a contraction in economic activity, possibly accompanied by outright deflation, amplified by widespread financial strains. Accordingly, one could argue that the more serious "bubble" was in the real economy itself.

In this scenario, the consequences of failing to act early enough can be serious. If the contraction in economic activity is deep enough and prices actually decline, they can cripple the effectiveness of monetary policy tools and undermine the credibility of institutions. The Japanese experience is very instructive here. Moreover, reaction functions that are seen to imply asymmetric responses, lowering rates or providing ample liquidity when problems materialise but not raising rates as imbalances build

up, can be rather insidious in the longer run. They promote a form of moral hazard that can sow the seeds of instability and of costly fluctuations in the real economy.

This paradigm sees the financial imbalances as contributing to, but, more importantly, as signalling distortions in the real economy that will at some point have to be unwound. In other words, the behaviour of prices of goods and services is not a sufficient statistic for those distortions. This runs contrary to the standard macroeconomic models used nowadays.[48]

From a policy perspective, the modification in policy rules we are suggesting is in fact fully consistent with long-cherished central bank values.

For one, it emphasises *long horizons* rather than short-term inflation control. It is precisely in order to maintain sustained price stability over horizons longer than two years, not jeopardised by deflationary pressures, which are harder to control, that a prompt response to financial imbalances would be called for.[49] Financial stability would result as a by-product. In this sense, the pursuit of price stability, properly defined, would still be the best contribution that monetary policy could make to financial stability.

In addition, the suggested modification highlights *pre-emptive actions*. This has been a perennial concern of central banks. It is precisely one of the purported reasons for the increased focus on monetary aggregates in the 1970s: the fear that waiting to see clear signs of higher inflation would be too risky. In a way, the more explicit focus on financial imbalances harks back to this intellectual tradition. The emphasis, however, is on credit rather than money. And no automatic responses (strict targets) are being proposed.

6. Conclusions

This paper has argued that financial imbalances can build up in low inflation environments and that in some cases it is appropriate for policy to respond to these imbalances. Indeed, the current configuration of arrangements in the monetary and financial spheres may well have increased the likelihood of low inflation co-existing with the development of imbalances in the financial system. Monetary policy rules that do not take these imbalances into account may unwittingly accommodate their further build up. The same could be said for prudential policy. Against this background, there is a risk of greater amplitude in financial cycles going hand in hand with more disruptive booms and busts in real economic activity. A policy response worthy of serious consideration would be a strengthening of the system-wide focus in the prudential framework coupled with a greater willingness of monetary authorities to respond to the occasional development of financial imbalances that pose a threat to the ongoing health of the macroeconomy. Greater co-operation between monetary and prudential authorities is important, not just in the management of crises, as well understood today, but also in preventing their emergence.

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[48] As much in economics, this point, of course, is not new. In the inter-war years there was a heated debate on this issue. See, for instance, Haberler (1932), Laidler (1999) for a review, and Bernard and Bisignano (2001) for a look at the Austrian School. See also Selgin (1997) for a review of the debate on productivity norms. The notion that responding to inflation will, over time, guarantee appropriate macroeconomic outcomes has been formalised, for instance, in so-called Neo-Keynesian models (Rotenberg and Woodford (1999)). More generally, however, it permeates all the mainstream macroeconomic approaches. It is also reflected, for example, in the common prescription that following stronger productivity growth central banks should reduce interest rates if and as inflationary pressures abate (e.g. Taylor (1999) and Clarida et al (1999)). From a Wicksellian perspective, however, this would normally result in a reduction in the real interest rate precisely at a time when the natural rate would rise. If a lower or constant real interest rate can be kept for long *without* the disequilibria showing up in inflation, then presumably they should emerge elsewhere. Financial imbalances would be obvious candidates. On some of these issues, see Amato (forthcoming).

[49] Kent and Lowe (1997) provide a theoretical justification for this view; Shiratsuka (2001) makes a similar point with reference to the notion of "sustainable" price stability. For arguments in favour of raising interest rates on financial stability grounds, see also Borio et al (1994) and Cecchetti et al (2000); Okina et al (2000) do so with reference to the recent Japanese experience. Goodhart (1995), drawing in part on the theoretical paper by Alchian and Klein (1973) on the correct definition of inflation, also highlights the need to take the behaviour of asset prices into account in the setting of monetary policy. BIS (1998) contains a series of contributions by central bank economists on the appropriate role of asset prices in monetary policy.

We are fully aware of the difficult technical and political economy issues that such a policy shift would entail. We believe, however, that it would be unwise to rule it out a priori. A precondition would be a greater consensus than exists at present regarding the nexus between monetary and financial stability and about the role of monetary and prudential policies in influencing the business cycle. To that end, further work appears desirable in at least three areas.

The first is *more and better data*. There is, in particular, a remarkable dearth of data on real estate prices, despite their proven role in the genesis of financial crises and, increasingly, in influencing the business cycle. Data gathering has so far been largely left to the initiative of private firms, which naturally tailor the data to their own requirements. Given the "public good" properties of the data, there seems to be a good case for official authorities to put efforts in this area.

The second is *more and better empirical research* aimed at identifying the set of conditions that increases the likelihood of financial strains. This paper has attempted to take a small step in this direction. Such work should pay greater attention to conceptual paradigms (e.g. cumulative processes, sets of variables) and be more closely tailored to the need of policy makers (e.g., horizons, exclusive use of ex ante information, balance between Type I/Type II errors). The definition of the relevant financial strains, not examined here, is another area meriting more attention; for instance, a broader definition of generalised credit and asset price strains may be more appropriate. We believe that there is considerable potential in this field; the corresponding literature is just in its infancy. Moreover, as firms' risk management systems become more sophisticated and financial institutions strengthen disclosure, data availability should greatly improve over time.

The third is *more and better analytical research* into the nature of the interaction between financial and real factors as determinants of business fluctuations. This should aim to clarify the conditions under which unsustainable booms in economic activity show up as financial imbalances rather than as obvious inflationary pressures. The explicit inclusion of the financial sector and a meaningful interaction with the process of capital accumulation would seem to be prerequisites for any such exercise. This line of work could help guide empirical research and provide a sounder basis for the formation of an intellectual and policy consensus.

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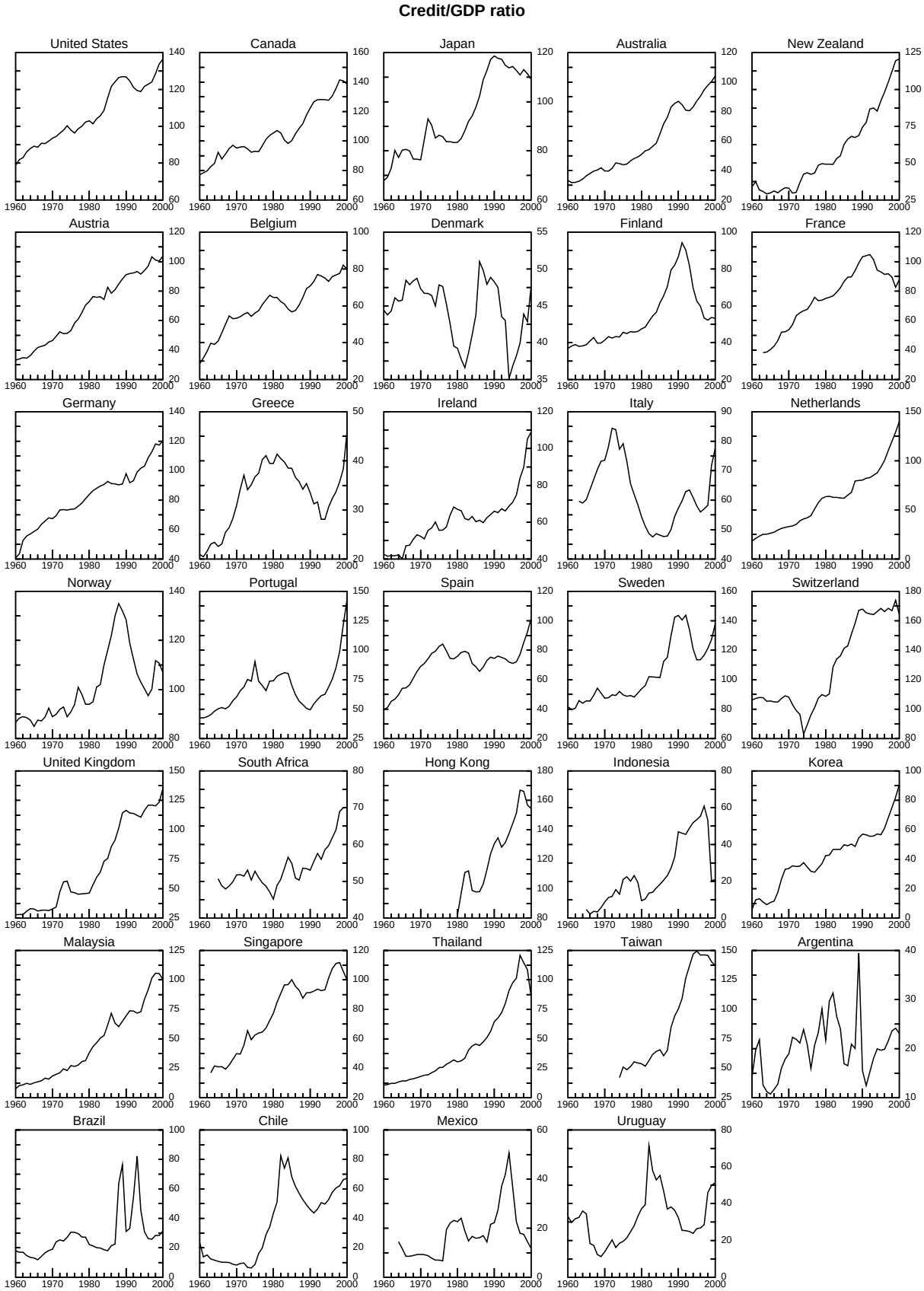
Appendix 1: Credit to GDP ratios



Appendix 2: Multiple indicator results for two- and three-year horizon

Table A2.1: Performance of joint indicators – two-year horizon

Asset prices and credit*				Investment and credit*			
threshold for credit gap	threshold for asset price gap	noise / signal	% predicted	threshold for credit gap	threshold for investment gap	noise / signal	% predicted
4	30	.11	53	4	1	.18	55
4	40	.08	53	4	2	.17	53
4	50	.08	47	4	3	.17	50
4	60	.06	34	4	4	.16	45
5	30	.10	47	5	1	.16	55
5	40	.07	47	5	2	.15	53
5	50	.08	42	5	3	.15	50
5	60	.06	32	5	4	.14	45
6	30	.10	42	6	1	.15	50
6	40	.08	42	6	2	.14	47
6	50	.08	37	6	3	.14	45
6	60	.05	32	6	4	.13	39
7	30	.09	42	7	1	.13	47
7	40	.07	39	7	2	.12	45
7	50	.08	34	7	3	.12	45
7	60	.05	32	7	4	.11	37

*. The threshold values for the credit gap are defined in terms of the deviation in *percentage points* of the actual credit ratio from the trend ratio. For the other two gaps, the threshold values are expressed as *percentage* deviations from the trend.

Table A2.2: Performance of joint indicators – three-year horizon

Asset prices and credit*				Investment and credit*			
threshold for credit gap	threshold for asset price gap	noise / signal	% predicted	threshold for credit gap	threshold for investment gap	noise / signal	% predicted
4	30	.09	55	4	1	.16	55
4	40	.06	55	4	2	.15	53
4	50	.06	50	4	3	.15	50
4	60	.04	37	4	4	.15	45
5	30	.08	50	5	1	.14	55
5	40	.05	50	5	2	.13	53
5	50	.06	45	5	3	.13	50
5	60	.04	34	5	4	.12	45
6	30	.08	45	6	1	.13	50
6	40	.05	45	6	2	.12	47
6	50	.05	39	6	3	.12	45
6	60	.03	34	6	4	.12	39
7	30	.08	42	7	1	.11	47
7	40	.05	39	7	2	.10	45
7	50	.06	34	7	3	.10	45
7	60	.03	34	7	4	.10	37

*. The threshold values for the credit gap are defined in terms of the deviation in *percentage points* of the actual credit ratio from the trend ratio. For the other two gaps, the threshold values are expressed as *percentage* deviations from the trend.

Table A2.3: Performance of the three indicators combined – two-year horizon

Asset prices, credit and investment*									
threshold for credit gap	threshold for asset price gap	threshold for investment gap	noise / signal	% predicted	threshold for credit gap	threshold for asset price gap	threshold for investment gap	noise / signal	% predicted
4	30	0	.10	42	5	30	0	.09	39
4	30	1	.11	39	5	30	1	.10	27
4	30	2	.10	37	5	30	2	.09	34
4	30	3	.11	32	5	30	3	.11	29
4	30	4	.11	26	5	30	4	.11	24
4	40	0	.08	42	5	40	0	.07	39
4	40	1	.09	39	5	40	1	.08	37
4	40	2	.08	37	5	40	2	.08	37
4	40	3	.09	34	5	40	3	.07	34
4	40	4	.08	26	5	40	4	.08	24
4	50	0	.08	37	5	50	0	.08	34
4	50	1	.08	34	5	50	1	.08	32
4	50	2	.08	32	5	50	2	.08	29
4	50	3	.09	29	5	50	3	.10	24
4	50	4	.09	21	5	50	4	.09	18

*. The threshold values for the credit gap are defined in terms of the deviation in *percentage points* of the actual credit ratio from the trend ratio. For the other two gaps, the threshold values are expressed as *percentage* deviations from the trend.

Table A2.4: Performance of the three indicators combined – three-year horizon

Asset prices, credit and investment*									
threshold for credit gap	threshold for asset price gap	threshold for investment gap	noise / signal	% predicted	threshold for credit gap	threshold for asset price gap	threshold for investment gap	noise / signal	% predicted
4	30	0	.07	47	5	30	0	.06	45
4	30	1	.08	42	5	30	1	.07	39
4	30	2	.10	37	5	30	2	.07	37
4	30	3	.09	34	5	30	3	.08	32
4	30	4	.08	29	5	30	4	.08	26
4	40	0	.06	47	5	40	0	.05	45
4	40	1	.06	42	5	40	1	.05	39
4	40	2	.06	39	5	40	2	.05	37
4	40	3	.07	34	5	40	3	.06	32
4	40	4	.06	29	5	40	4	.05	26
4	50	0	.05	42	5	50	0	.05	39
4	50	1	.06	37	5	50	1	.06	34
4	50	2	.06	34	5	50	2	.06	32
4	50	3	.07	29	5	50	3	.07	26
4	50	4	.07	24	5	50	4	.06	21

*. The threshold values for the credit gap are defined in terms of the deviation in *percentage points* of the actual credit ratio from the trend ratio. For the other two gaps, the threshold values are expressed as *percentage* deviations from the trend.

Conference programme: "Changes in risk through time: measurement and policy options"

Tuesday 5 March 2002

7.30 pm **Informal dinner at the Gasthhof zum Goldenen Sternen (Sternensaal)**

Wednesday 6 March 2002

9.00 to 9.10 am **Welcome by André Icard (BIS)**

Chair: William White (BIS)

9.10 to 10.40 am **The measurement of credit risk over the cycle**

Presentation by Linda Allen (City University of New York)
Presentation/comment by Richard Cantor (Moody's Investors Service)
Presentation/comment by Stephen Kealhofer (KMV Corporation)
Presentation/comment by Thomas Wilde (Credit Suisse First Boston)

10.40 to 11.00 am **Coffee/tea break**

11.00 to 11.50 am **The link between default and recovery rates: effects on the procyclicality of regulatory capital ratios**

Authors: Ed Altman (New York University), Andrea Sironi (Bocconi) and Andrea Resti (University of Bergamo)

Discussants: Richard Herring (University of Pennsylvania) and Hiroshi Nakaso (Bank of Japan)

11.50 to 12.40 pm **Credit risk modeling and the cyclicality of capital**

Authors: Eric Rosengren, John Jordan (Federal Reserve Bank of Boston) and Joe Peek (University of Kentucky)

Discussants: Timothy Wilson (Morgan Stanley) and Patricia Jackson (Bank of England)

12.40 to 2.00 pm **Buffet lunch**

2.00 to 2.50 pm **Institutional memory, the business cycle and bank lending behaviour**

Authors: Allen Berger (Board of Governors of the Federal Reserve System) and Gregory Udell (Indiana University)

Discussants: Charles Calomiris (Columbia University) and David Carse (Hong Kong Monetary Authority)

2.50 to 3.40 pm **Asset prices, financial and monetary stability: exploring the nexus**

Authors: Claudio Borio and Philip Lowe (BIS)

Discussants: Benjamin Friedman (Harvard University) and Lars Heikensten (Sveriges Riksbank)

3.40 to 4.00 pm **Coffee/tea break**

4.00 to 6.00 pm **Panel discussion**

Charles Goodhart (London School of Economics)
Jeffrey Carmichael (Australian Prudential Regulation Authority)
Arturo Estrella (Federal Reserve Bank of New York)
George Kaufman (Loyola University of Chicago)
Hans Genberg (Graduate Institute of International Studies, Geneva)

7.30 pm **Dinner at the Schloss Bottmingen (Rittersaal)**

List of participants

Chair: William White

Viral Acharya
London Business School

Linda Allen
City University of New York

Franklin Allen
University of Pennsylvania

Edward Altman
Leonard N Stern School of Business, New York University

Harald Benink
Erasmus University of Rotterdam

Allen Berger
Board of Governors of the Federal Reserve System

Anders Borg
Sveriges Riksbank

Charles Calomiris
Columbia University

Richard Cantor
Moody's Investors Service

Jeffrey Carmichael
Australian Prudential Regulation Authority

David Carse
Hong Kong Monetary Authority

Jon Danielsson
London School of Economics

Alain Duchateau
Banque de France and Commission Bancaire

Arturo Estrella
Federal Reserve Bank of New York

Benjamin Friedman
Harvard University

Hans Genberg
Graduate School of International Studies, Geneva

Stefan Gerlach
Hong Kong Monetary Authority

Charles Goodhart
London School of Economics

Juan Pablo Graf
Banco de Mexico

Mauro Grande
European Central Bank

Lars Heikensten
Sveriges Riksbank

Richard Herring
University of Pennsylvania

Ryozo Himino
Financial Services Agency, Japan

Patricia Jackson
Bank of England

Alejandro Jara
Banco Central de Chile

Graciela Kaminsky
George Washington University

George Kaufman
Loyola University of Chicago

Stephen Kealhofer
KMV Corporation

Paul Kupiec
International Monetary Fund

Myron Kwast
Board of Governors of the Federal Reserve System and Swiss National Bank

Erich Loeper
Deutsche Bundesbank

Jose Lopez
Federal Reserve Bank of San Francisco

Giovanni Majnoni
The World Bank

Hiroshi Nakaso
Bank of Japan

Paolo Marullo Reedtz
Banca d'Italia

Rafael Repullo
Centro de Estudios Monetarios y Financieros (CEMFI)

Andrea Resti
University of Bergamo

Eric Rosengren
Federal Reserve Bank of Boston

Jesus Saurina
Banco de España

Emmanuelle Sebton
International Swaps and Derivatives Association, London

Hyun Song Shin
London School of Economics

Emil Steffensen
The Banking, Insurance and Securities Commission, Norway

Thierry Timmermans
National Bank of Belgium

Gregory Udell
Indiana University

Iman van Lelyveld
De Nederlandsche Bank

Thomas Wilde
Credit Suisse First Boston

Timothy Wilson
Morgan Stanley

Claudio Borio
Philip Lowe
William White
Bank for International Settlements

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