HONG KONG INSTITUTE FOR MONETARY RESEARCH

DEFLATION, CREDIT AND ASSET PRICES

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HKIMR Working Paper No.13/2003

July 2003

HKIMR®

Deflation, Credit and Asset Prices*

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July 2003

Abstract

The experience of historical episodes of financial crises in the late 19th and early 20th century, and also more recent episodes of boom and bust cycles in credit markets suggest that the build up of financial imbalances is reflected in asset prices, especially property prices, rather than in consumer prices. Based on a simple VAR impulse response analysis for a sample of twelve countries we assess the nature of the close empirical correlation between bank lending and asset prices. The results suggest that innovations to property prices have a significant effect on bank lending in the large majority of countries. For most countries we do not find evidence of a significant effect of credit on property prices or of significant dynamic interaction between share prices and credit in either direction. Interest rate innovations are found to have a significantly negative effect on asset prices in some countries, while bank lending is in general found to be rather unresponsive to interest rate movements. This finding suggests that the usefulness of interest rate policy as an instrument to smooth boom-bust cycles in asset and credit markets is questionable.

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1. Introduction

Over the last two decades, most industrialised and developing countries have experienced episodes of boom and bust in credit markets. These credit cycles often coincided with cycles in economic activity and asset prices. The unwinding of the imbalances built up in the boom has in some cases led to severe problems in the financial sector, sometimes culminating in an outright banking crisis. In Japan, the second biggest economy of the world, asset price deflations, both in equity and property, were followed by a decade of financial fragility and deflationary developments in goods prices, with consumer prices now falling continuously since 1999. With short-term interest rates having reached the zero lower bound, the country appears to be trapped in a deflationary spiral out of which it finds itself unable to escape. Other South East Asian countries, such as Hong Kong and Singapore, have also experienced asset price deflations followed by a marked drop in credit creation and goods price deflation in recent years. Some commentators argue that the U.S. and other industrialised countries are also now, in the wake of the worldwide slump in share prices, on the brink of deflation.[1]

Both the experience from historical episodes of financial crisis in the late 19th and early 20th century and from recent boom-bust cycles in credit markets, suggest that consumer prices respond with a lag to developments in credit markets. Consumer price inflation is often low or falling during credit booms and peaks after the onset of the bust. Asset prices, especially property prices, on the other hand, appear to follow closely behind or even to lead bank lending.

The recurrence of boom and bust cycles in asset and credit markets, followed by financial sector distress and deflationary pressures on goods prices has led to a resurgence of both academic and policy interest in the interlinkages between asset, credit and goods markets. As a result, Irving Fisher's (1933) theory of debt deflation, which was motivated by the deflationary spirals evolving in the U.S. and other countries during the Great Depression 1929-1932, has gained new topicality. Fisher developed a chain of interlinkages between asset prices, goods prices, economic activity and the financial sector, which may set in motion a deflationary spiral once a negative shock occurs.[2] After a wave of optimism and confidence, leading to overinvestment, excess indebtedness and inflated asset prices, households' and firms' balance sheets are highly exposed to asset price and interest rate movements. A sudden drop in confidence triggers a desire to reduce debts, followed by asset liquidation, a fall in asset prices and rising real interest rates.[3] The resulting reduction of borrowers' net worth triggers a surge in bankruptcies, contraction of bank lending, and a fall in output. These developments lead to a further weakening of confidence, further falls in asset prices, falling consumer prices leading to a further reduction of borrowers' net worth, so that a deflationary spiral gradually evolves. The process is reinforced by negative repercussions on the balance sheets of financial institutions due to falling asset values and rising rates of default and non-performing loans.[4]

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[1] See for example *The Economist* of 10 October 2002 'Of debt, deflation and denial'.

[2] King (1994) provides an overview and a contemporaneous interpretation of Fisher's debt deflation theory. See also Bernanke (1983).

[3] Real interest rates increase because a negative shock to asset prices raises the conditional volatility of returns so that lenders demand a higher risk premium.

[4] The negative effect of collapsing asset and goods prices on banks' balance sheets was already stressed by Keynes (1931).

At the heart of the debt deflation theory is the effect of falling asset and goods prices on the borrowing capacity of investors. Falling asset prices reduce the value of borrower's assets, while falling goods prices increase the real value of their debts, eroding their net worth. Recent theoretical advances in understanding the interlinkages between asset prices, the financial system and the real economy, such as the business cycle models developed by Bernanke and Gertler (1989) and Kiyotaki and Moore (1997), are all more or less rooted in Fisher's theory of debt deflation. In these models, a financial accelerator, working via the effect of asset prices on the borrowing capacity of households and firms, amplifies the macroeconomic effects of productivity shocks. However, the financial accelerator could also be an independent source of business cycle fluctuations, transmitting shocks to asset prices, reflecting a wave of justified or unjustified optimism about future economic prospects, or shocks to credit, reflecting financial liberalisation or a credit demand disturbance to the real economy.

In any case, the existence of a financial accelerator or debt deflation mechanism implies a close empirical correlation between bank lending and asset prices. Such a close correlation, especially between bank lending and property prices, has in fact been widely documented in the policy-oriented literature (e.g. IMF, 2000; BIS, 2001). But whether this correlation is merely driven by the business cycle as a common factor or whether credit or asset price shocks also play an independent role remains an open empirical question.

In the following we will assess the effect of independent movements in credit and asset prices for a sample of twelve countries. The sample of countries comprises the G7, three Nordic countries (Sweden, Norway and Finland), which have experienced financial sector distress in the late 1980s - early 1990s, and two Asian countries (Hong Kong and Singapore), which have recently experienced deflationary pressures in the wake of boom-bust cycles in credit and asset markets. A simple impulse response exercise suggests that property price innovations have a significant effect on bank lending, while credit shocks appear to affect property prices in only a few countries. Shocks to equity prices do not appear to have a significant effect on bank lending, nor do credit shocks have a significant effect on equity prices in the majority of countries.

Since price stability is defined in terms of the consumer or retail price index, a policy conflict between the goals of financial stability and price stability may arise in times of a credit boom because of the lagged response of consumer prices to the build up of financial imbalances. Developments in the financial sector may call for a monetary tightening, while consumer price inflation may not give any signal of overheating.[5] Signals of overheating may rather be evident in asset markets. Goodhart (1995) argues that this is one reason why a definition of price stability in terms of a broader based price index also including asset prices, especially housing prices, might be preferable.[6]

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[5] An example of this dilemma is the recent development in the U.K., where sharply rising house prices raise concerns about financial fragility while consumer price inflation stays at moderate levels.

[6] The general case for a broader based price index is made by Alchian and Klein (1973). They argue that assets represent claims on future consumption, so that a correct measure of inflation would also need to include asset prices in order to account for the expected price of future consumption. An early reference of this line of thought is, again, Fisher (1911), who states that 'To base our index number [of purchasing power] for time contracts solely on services and immediately consumable goods would be illogical' (p. 174).

The role of asset prices in the conduct of monetary policy has turned out to be a highly controversial issue. Cecchetti, Genberg, Lipsky and Wadwhani (2000) argue in favour of a direct response of monetary policy to asset price movements which are not in line with perceived fundamentals, while Bernanke and Gertler (1999) and Gertler, Goodfriend, Issing and Spaventa (1998) argue against. Bordo and Jeanne (2002) show that whether an active response of monetary policy to asset prices is beneficial or not depends in a highly non-linear way on private sector sentiment and confidence.

A rather neglected issue is the question of how monetary policy can actually influence asset prices and bank lending in order to contain financial cycles. There is only scarce empirical evidence on the effect of interest rate movements on asset prices in general. Based on a simple impulse response exercise we investigate the effect of interest rate shocks on economic activity, asset prices and bank lending. The results suggest that interest rate innovations have a significantly negative effect on asset prices, while bank lending is found to be rather unresponsive to interest rate shocks. These findings lend only weak support to the view that interest rate policy is a useful instrument to smooth cycles in asset and credit markets. Moreover, the effect of interest rate movements on asset prices and bank lending is most likely a highly non-linear function of market sentiment, being rather ineffective in times of boom and bust, and highly effective at the time market sentiment changes. A successful smoothing of cycles in asset and credit markets therefore may only be possible if monetary policy acts *before* an upswing has turned into a boom. But when exactly this is the case is almost impossible to tell ex-ante. Such a policy may also involve interest rate hikes in times of low or falling headline inflation rates, which will prove to be difficult for a central bank to justify either to the public or politicians.

The plan of the paper is as follows. In Section 2 we investigate the historical record of financial crises and deflation and the co-movements of consumer prices and asset prices and bank lending in recent times. Section 3 discusses the theoretical background for the co-movements between asset prices and bank lending and presents evidence from a simple impulse response exercise. In Section 4 we discuss the potential role of interest rate policy as an instrument to smooth financial cycles. Section 5 concludes.

2. Deflation and Financial Fragility: The Historical Record

In this section we will explore the behaviour of consumer prices during historical episodes of financial crises of the late 19th and early 20th century, and the correlation between credit growth and consumer and asset prices more recently since the mid 1980s.

First we look at nine pre-1914 episodes of financial crisis analysed in Delargy and Goodhart (1999) and the Great Depression in the U.S. 1929-32. The crisis episodes analysed by Delargy and Goodhart comprise the 1873 crises in the U.S. and Austria, the 1890 crises in the U.S. and Australia, the 1893 crises in the U.S., Australia and Italy and the 1907 crises in the U.S. and Italy.[7] Delargy and Goodhart describe the period prior to these crisis episodes as being characterised by credit booms and unsustainable rates of output growth. The Great Depression, preceded by the U.S. stock market crash of October 1929, also

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[7] In addition to the nine crises referred to here, Delargy and Goodhart (1999) also analyse the 1890 financial crisis in Argentina. We could not analyse this crisis episode here because we were not able to find consumer or wholesale price data for Argentina for this period.

followed a boom in bank lending and the stock market. Average growth rates of bank lending and the Standard & Poor's Composite Index between 1925 and 1928 were 5.5 per cent and 20 per cent respectively.

Figure 1 shows the development of the change in consumer prices (wholesale prices for Austria) in the two years before and after the crisis. The graphs reveal that in all cases consumer prices were falling for at least one year after the onset of the crisis. In the 19th century crises, goods prices did not show any sign of overheating prior to the crisis. Inflation rates were either falling or negative. In the two 1907 crises, inflation picked up just in the year of the crisis. Likewise, in the two years before the onset of the Great Depression, consumer prices were stable or even falling. Thus, in no case did consumer prices give an early warning signal of overheating in the financial sector.

Long runs of historical data on credit aggregates and asset prices are unavailable for most countries, so that we cannot provide an assessment of the behaviour of asset prices around the crisis episodes. The exception is the U.S., where we were able to find data for total bank lending, the Standard & Poor's index of common stocks and the price index for single family houses in the Historical Abstract of the United States published by the U.S. Bureau of the Census (1960). Figure 2 shows the co-movement of the percent change in total bank lending (dotted line, right hand scale) and respectively the percent change in the consumer price index, the share price index and the house price index (solid line, left hand scale). The graphs reveal that contractions in bank lending in the wake of the financial crises in 1893, 1907 and 1929 and also 1921 were accompanied by consumer price deflations. Prior to the 1893 and 1907 crisis, bank lending was growing at a brisk pace, while consumer price inflation was flat. The same holds for the mid 1920s, where lending was growing at high rates and consumer price inflation was low or negative.

The second graph in Figure 2 suggests that, except for the period 1910-20, credit booms were associated with high rates of share price inflation. This holds in particular for the periods prior to the 1907 crisis and prior to the Great Depression. House prices were highly volatile before 1918, so that no clear correlation between house price inflation and credit growth emerges. After 1918 the correlation appears to be somewhat closer, but while the sharp drops in credit growth in 1921 and 1929 were accompanied by falling house prices, the credit boom prior to the Great Depression was not reflected in high rates of house price inflation. Like consumer prices, house prices were basically falling since 1925.

Historical U.S. data, therefore, suggest that credit is closely correlated with equity prices rather than consumer or property prices, especially in times of a credit boom. A somewhat different picture emerges when we look at more recent data. Figures 3, 4 and 5 display the co-movement of credit growth (dotted line, right hand scale), defined as the year-on-year percent change in bank lending to the private non-bank sector, and respectively the year-on-year percent change in the consumer price index, the equity price index and the residential property price index (solid line, left hand scale). The sample of countries comprises the G7, three Nordic countries (Sweden, Norway and Finland) and two South East Asian countries (Hong Kong and Singapore). The sample period is first quarter 1985 to fourth quarter 2001.

Figure 3 suggests that credit growth is generally leading consumer price inflation. The credit boom experienced by most industrialised countries in the late 1980s was often accompanied by low or falling

rates of consumer price inflation. When the boom turned into a bust in the early 1990s, consumer prices often continued to rise and peaked several quarters after credit growth. In the late 1990s, again many counties experienced high rates of credit growth together with low or falling rates of CPI inflation. In Hong Kong, credit growth also leads CPI inflation by several quarters, while in Singapore the correlation appears to be rather coincident. Figures 4 and 5 show that credit and property prices follow the same cycle swings, with house price inflation leading credit growth, rather than conversely. On the other hand, the movements in credit and share prices appear to be largely uncorrelated due to the high volatility of share price movements.

3. Credit and Asset Prices: Theory and Evidence

Theory

In the previous section we have shown that bank lending has, in recent decades, been closely correlated with property prices. There are various theoretical explanations for such a close empirical correlation. First, asset prices may have a direct wealth effect on credit demand. Asset prices affect consumers' perceived lifetime wealth, inducing them to change their spending and borrowing plans in order to smooth consumption over the life cycle.[8] A change in asset prices may therefore induce a change in credit demand in the same direction.

Second, households and firms may be borrowing constrained due to asymmetric information in the credit market, which gives rise to adverse selection and moral hazard problems. As a result, households and firms can only borrow when they can offer collateral, so that their borrowing capacity is a function of their collateralisable net worth, which is in turn a positive function of asset prices.[9]

Third, as has already been stressed by Keynes (1931), asset prices also affect the value of bank capital, both directly to the extent that banks own assets, and indirectly by affecting the value of loans secured by assets.[10] Via their effect on banks' balance sheets, asset prices influence the risk taking capacity of banks and thus their willingness to extend loans.

Since loans are commonly secured by property, rather than by equity (Borio, 1996), and since property makes up a substantially larger share of private sector wealth than equity (OECD, 2000), it may be expected that property prices have a larger effect on households', firms' and banks' balance sheets than equity prices.

Kindleberger (1978) and Minsky (1982) argued that credit conditions may also affect asset valuations, so that mutually reinforcing boom-bust cycles in credit and asset markets may evolve. In standard asset pricing models it is of course difficult to make a case for a role of credit conditions. Real asset prices

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[8] The lifecycle model of household consumption was originally developed by Ando and Modigliani (1963). A formal exposition of the lifecycle model can be found in Deaton (1992) and Muellbauer (1994).

[9] Basic references of this literature are Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). For a survey see Bernanke, Gertler and Gilchrist (1998).

[10] Chen (2001) develops an extension of the Kiyotaki and Moore (1997) model where an additional amplification of business cycles results from the effect of asset price movements on banks' balance sheets.

depend on the discounted future stream of real dividend payments. In this framework higher liquidity may only have an indirect effect by lowering interest rates and thus the discount factors or by indicating brighter economic prospects and thus higher expected dividend payments. However, asset prices may not always obey asset pricing formulae, and it may simply be that additionally available liquidity increases the demand for a (temporarily) fixed supply of assets, which results in higher real asset prices.

Empirical evidence

Little empirical research has been done on the relationship between credit and asset prices. Most studies rely on a single equation setup, either relating indicators of financial distress or credit aggregates to asset prices or relating asset price developments to credit conditions. Goodhart (1995) investigates the determinants of credit growth in the U.S. and the U.K. over a long sample period (U.S. 1919-1991, U.K. 1939-1991) using annual data, regressing the change in bank lending on the change in house prices, the change in equity prices and several other explanatory variables. For the U.S. he finds a significant coefficient for the change in stock prices, but not for the change in house prices, a finding that is consistent with our descriptive analysis of the historical U.S. data in the previous section. For the U.K. he finds that the change in house prices had a strong and highly significant effect on credit growth, while the change in stock prices came out insignificantly and even wrongly signed. Rolling regression estimates suggest for the U.K. that the relationship between credit and house price has strengthened over the post-war period, whereas the relationship between credit and share prices has weakened.

Hutchison and McDill (1999) and Hilbers, Lei and Zacho (2001) find that the change in share prices and the change in residential property prices significantly enter multivariate probit-logit models to explain the outbreak of financial distress in industrialised and developing countries. Borio and Lowe (2002) show that a measure of the aggregate asset price[11] gap, measured as the deviation of aggregate asset prices from their long-run trend, combined with a similarly defined credit gap measure, is a useful indicator of financial distress in industrialised countries.

Borio, Kennedy and Prowse (1994) investigate the relationship between credit to GDP ratios and aggregate asset prices for a large sample of industrialised countries over the period 1970-1992 using annual data. They focus on the determinants of aggregate asset price fluctuations, hypothesising that the development of credit conditions as measured by the credit to GDP ratio can help to explain the evolution of aggregate asset prices. They find that adding the credit to GDP ratio to an asset pricing equation helps to improve the fit of this equation in most countries. Based on simulations they demonstrate that the boom-bust cycle in asset markets of the late 1980s - early 1990s would have been much less pronounced or would not have occurred at all had credit ratios remained constant. For a panel of four East Asian countries (Hong Kong, Korea, Singapore and Thailand), Collyns and Senhadji (2002) find that credit growth has a significant contemporaneous effect on residential property prices. They conclude that bank lending has contributed significantly to the real estate bubble in Asia prior to the 1997 East Asian crisis.

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[11] Aggregate asset price indices are calculated as a weighted average of residential property prices, commercial property prices and equity prices. The weights are based on the share of each asset in national private sector balance-sheets, which are derived based on national flow-of-funds data or UN standardised national accounts.

None of these studies, however, control for potential simultaneity, which is strongly suggested by our prior theoretical considerations. The findings therefore do not tell us anything about the direction of causality between credit and asset prices. Gerlach and Peng (2003) and Hofmann (2001) analyse the relationship between bank lending and property prices respectively for Hong Kong and for a set of industrialised countries, based on a multivariate empirical framework. Both studies find that both long-run and short run causality goes from property prices to credit.

A simple impulse response exercise

In the following exercise we also use a multivariate modelling approach in order to analyse the relationship between bank lending and equity and property prices. We estimate a VAR comprising real bank lending, real GDP, real equity prices, real property prices and a short-term real interest rate. The analysis covers twelve countries: the G7, Sweden, Norway, Finland, Hong Kong and Singapore. The sample period is first quarter 1985 to fourth quarter 2001. We do not perform an explicit analysis of any potential long run relationships because of the relatively short sample period and large number of endogenous variables. By doing the analysis in levels, we allow for implicit cointegrating relationships in the data.

Nominal bank lending, share prices and property prices were transformed into real terms by deflation with the consumer prices index. The (ex-post) short-term real interest rate is measured as the three months interbank money market rate less annual CPI inflation. All data except for the share price index and the money market rate are seasonally adjusted. With the exception of the real interest rate, all data were transformed into natural logs. All data were taken from the BIS or the IMF database. Detailed information about the original source of the residential property price series can be found in the data appendix.

The VAR model estimated for each of the twelve countries under investigation is given by:

$$x_t = A_1 x_{t-1} + \dots + A_n x_{t-n} + \mu + \delta t + \varepsilon_t.$$

x is a vector containing the log of the real GDP, the log of real domestic credit, the log of real property prices, the log of real equity prices and the short-term real interest rate. t is a deterministic time trend. The lag order n was in each case determined based on sequential Likelihood Ratio tests.

In order to recover the structural shocks from the reduced form system we use a standard Cholesky decomposition. The ordering adopted here is the following: real GDP, real property prices, real bank lending, the real interest rate and real share prices. We therefore assume that real GDP does not respond contemporaneously to innovations to any of the other variables, but may affect all other variables within quarter. This assumption is fairly standard in the monetary policy transmission literature. We further assume that real property prices are rather sticky, so that they are not affected contemporaneously by credit, interest rates and share prices. Share prices are rather flexible and are allowed to respond within quarter to innovations to all other variables. Money market interest rates are also rather flexible, so that they are allowed to respond within quarter to innovations to economic activity, property prices and credit. The chosen ordering also reflects the common assumption that interest rate changes are transmitted to the economy with a lag. The chosen ordering of the variables has, in our view, the most intuitive appeal and also yields plausible impulse responses. The results are generally not sensitive to a

reordering of the variables. The exception is the ordering of the real interest rate and bank lending. Allowing for an immediate effect of interest rates on lending often yields an implausible positive response of bank lending to a positive interest rate shock.

Figures 6 displays standardised impulse responses of credit to asset price shocks and of asset prices to credit shocks in a two standard error confidence band. The results of the impulse response analysis are summarised in Table 1, where we report the number of significant impulse responses of each variable.[12] The findings suggest that property prices have a significant effect on bank lending, while the evidence of significant dynamic effects of credit shocks on asset prices or of equity price shocks on credit is rather weak. In ten out of twelve countries bank lending responds significantly positive to a property price shock. Only in Italy and in the U.K. is the dynamic effect of a property price shock on lending not significantly larger than zero. Credit shocks have a significant effect on equity prices only in one third of the countries, and on property prices only in two countries. Share prices shocks are found to affect bank lending significantly only in four out of twelve countries.

4. A role for monetary policy?

The findings of the two previous sections seem to suggest that monetary policy should respond actively to booms in credit and asset markets, both for the sake of financial stability and long-run price stability. In a recent paper, Bordo and Jeanne (2002) set up a small stylised model to investigate this issue. They consider two possible ways of conducting monetary policy: a reactive monetary policy that responds only to current economic conditions, and a proactive monetary policy that trades off current economic conditions against the future risk of a credit crunch caused by overborrowing combined with a drop in asset prices. Via its effect on firms' borrowing, monetary policy can reduce the risk of a future credit crunch at the expense of depressing current economic activity. It appears that the optimal response of monetary policy to the build up of financial imbalances depends in a highly non-linear way on private sector sentiment. For intermediate levels of "market exuberance" the proactive policy is preferable, while for low and high levels the reactive policy dominates.

In Bordo and Jeanne's model, monetary policy operates via firms' borrowing, while asset prices are assumed to be exogenous. There is only little evidence on the effect of interest rate movements on asset prices and bank lending. The VAR framework set up in the previous section enables us also to investigate the effect of innovations to the real interest rate.[13] Figure 7 displays the impulse responses of real GDP, real bank lending, real share prices and real property prices to a one standard deviation shock to the short-term real interest rate. We find that, across the board, interest rate shocks have, as expected, a negative effect on economic activity, lending and asset prices. In eight out of twelve counties interest rate shocks have significant effects. Only in the U.S., France, the U.K. and Hong Kong do we not find any significant effect of interest rate shocks. The results of the impulse response analysis are

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[12] Here we do not count the significantly negative response of property prices to credit shocks in Germany and the significantly negative response of share prices to credit shocks in Canada.

[13] The real interest rate shocks should, of course, not be interpreted as monetary policy shocks as such, since there are various variables missing from our simple empirical model which may affect interest rate policy, such as oil prices or the exchange rate.

summarised in Table 2 by reporting for each variable the number of significant impulse responses to the real interest rate shock. It appears that interest rate shocks have a significant effect on real output and real asset prices in about half of the countries under investigation. A significant effect on lending is found only in Canada.

These results suggest that, if anything, interest rate policy may contain the build up of financial imbalances via its effect on asset prices, while bank lending in general appears to be unresponsive to interest rate movements. On the whole, the results lend only weak support to the view that interest rate policy is a powerful tool to smooth cycles in credit and asset markets. Moreover, the effect of interest rate movements on asset prices and bank lending are most likely highly non-linear. During the boom, general euphoria will most likely lower the sensitivity of asset valuations and lending to interest rate hikes. Once market sentiment changes, investors realise how high interest rates have gone and asset prices start to tumble. Spreading pessimism may then again render interest rate cuts ineffective. A successful smoothing of cycles in asset and credit markets therefore seems to be only possible if monetary policy acts *before* an upswing has turned into a boom. But getting this timing right is an extremely difficult task, especially in times of low or falling headline inflation rates when public opposition to such a policy is most likely to be immense.

The two most (in)famous attempts of central banks to influence excesses in credit and asset markets have gone horribly wrong. Both the Fed's attempt to prick the U.S. stock market bubble in 1929 and the Bank of Japan's attempt to prick the Japanese real estate market bubble in 1989/90 triggered disastrous asset market crashes, followed by financial crises and deflations.

These two cases provide compelling anecdotal evidence of the highly non-linear effect of interest rates on asset prices. In Figure 8 we display the co-movement of the New York Fed Discount Rate and the Standard and Poor's Composite Index over the period 1925-1934 and of the Bank of Japan Discount rate and the country wide residential land price index over the period 1985-2001. The New York Fed increased its discount rate between January 1928 and October 1929 from 3.5 to 6 per cent without any effect on the stock market until the crash on October 24. Within one year after the crash, the discount rate fell to 2.5 percent, again without any effect on the sliding stock market. The Bank of Japan increased its discount rate from 2.5 percent in April 1989 to 6 percent in August 1990. While the Japanese stock market bubble burst in early 1990, land prices continued to increase until mid 1991. During the 1990s, successive rate cuts by the Bank of Japan proved to be ineffective to stop the economy from sliding into a deflationary spiral. In 2001 interest rates reached the zero lower bound while asset and consumer prices continued to fall.[14]

The recent experience of the Fed tells a similar story. Figure 8 shows that the second half of the 1990s was characterised by sharply rising stock prices and little variation in the Federal Funds rate. From 1995-1998 the Funds rate fell from around 6 per cent to below 5 per cent. From early 1999 till the end of 2000, the Fed raised rates modestly by 1.5 percentage points, partly in an attempt to curtail "irrational exuberance" in the stock market. These modest rate hikes did not have any noticeable effect on share

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[14] For a discussion of the Bank of Japan's policy record in the 1990s see Burdekin and Siklos (2002) and Hutchison (2002).

prices until the end of 2000, when a sharp reversal in stock prices set in and continued until the end of 2001, despite a drop in the Federal Funds rate by more than 4 percentage points to 2 per cent.

In all three cases the central bank might have been successful in preventing asset price bubbles from evolving, had monetary policy been tightened early enough. Instead of lowering the discount rate in 1927 the Fed would probably have done better to tighten monetary policy, the Bank of Japan may have done better to start raising interest rates already in 1987/88 and the Fed should probably have raised rates rather than lowering them in 1998. But such statements are easy to make with hindsight, and how different policies would have changed events is a highly hypothetical question.

5. Conclusions

Boom-bust cycles in credit markets, often followed by financial distress, depressed economic activity and deflation, have been a recurring phenomenon since the late 19th century. The experience of both historical episodes of financial crises in the late 19th and early 20th century and recent episodes of boom and bust cycles in credit markets suggest that consumer prices often do not show any sign of overheating during the credit boom prior to the crisis. The build up of financial imbalances appears to be reflected in asset prices, especially property prices.

Based on a simple VAR impulse response exercise for a sample of twelve countries, we assess the nature of the close empirical correlation between bank lending and asset prices. The results suggest that innovations to property prices have a significant effect on bank lending in the large majority of countries, while shocks to bank lending are found to have a significant effect on property prices in only few countries. For most countries we do not find evidence of significant dynamic interaction between share prices and credit in either direction.

The same empirical framework enables us to investigate the effect of interest rate innovations on economic activity, bank lending and asset prices. We find some evidence of a significantly negative effect of interest rate shocks on asset prices, while bank lending is found to be rather unresponsive to interest rate innovations across countries. This finding provides only weak support for the view that interest rate policy is a useful instrument to smooth boom-bust cycles in asset and credit markets.

Moreover, the effects of interest rate movements on asset prices and bank lending are most likely highly non-linear. During the boom, general euphoria will most likely lower the sensitivity of asset valuations and lending to interest rate hikes. Once market sentiment changes, investors realise how high interest rates have gone, triggering a sharp reversal in asset prices. Spreading pessimism may then again render interest rate cuts ineffective. The two most (in)famous attempts of central banks to influence asset prices, the U.S. Fed's attempt to prick the U.S. stock market bubble in 1929 and the Bank of Japan's attempt to prick the bubble in the Japanese real estate market in 1989/90, as well as the recent experience of the U.S. Fed, provide compelling evidence of the highly non-linear effect of interest rates on asset prices. Given that the driver of the non-linearity, market sentiment, is unobservable, the usefulness of interest rate policy as an instrument to safeguard financial stability is in doubt.

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Table 1. Summary of impulse response analysis

Significant effect of equity on credit	Significant effect of property on credit	Significant effect of credit on equity	Significant effect of credit on property
4	10	4	2

Table 2. Summary of interest rate responses

Significant effect on GDP	Significant effect on Credit	Significant effect on Equity	Significant effect on Property
6	1	6	7

Figure 1. Early Episodes of consumer price deflation and financial fragility
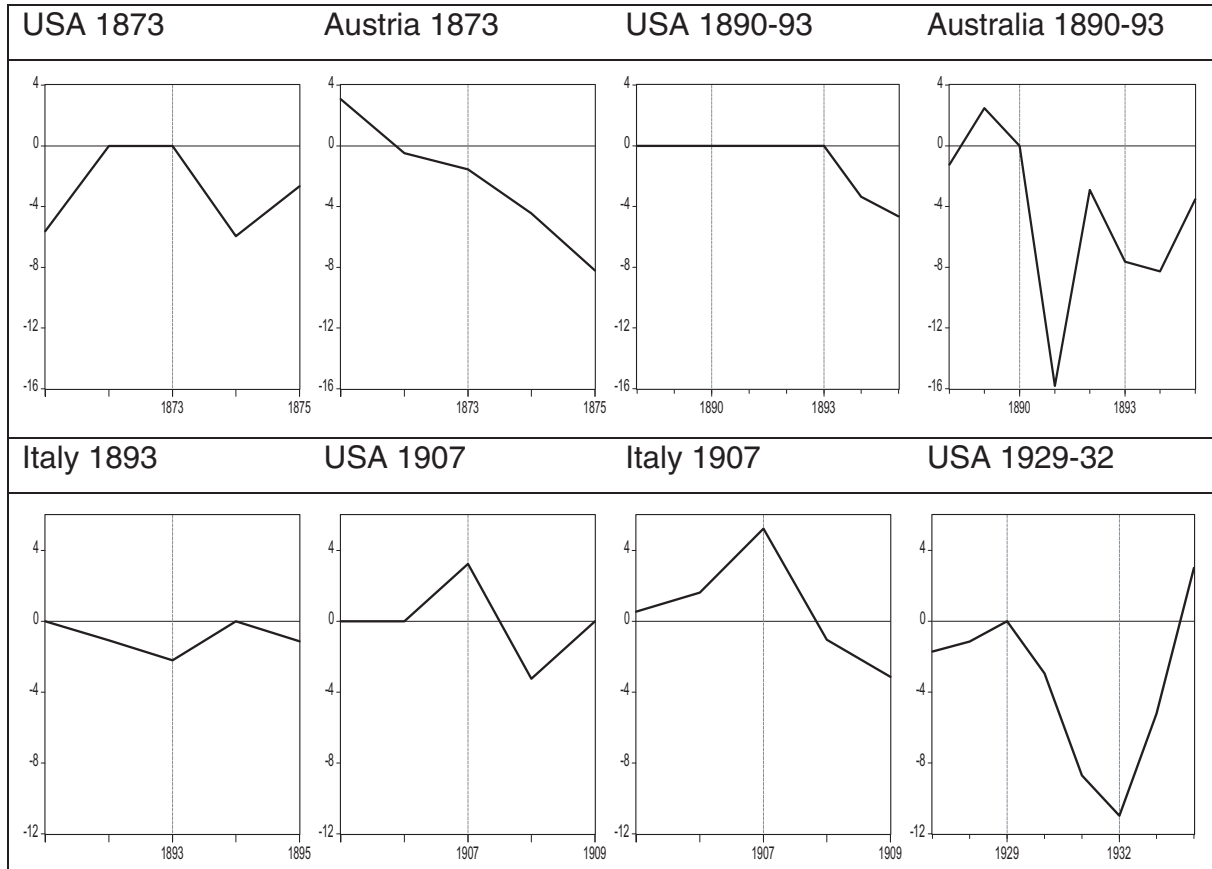
Source: Mitchell (1998)

Figure 2. Credit growth and inflation in the U.S. 1891-1934
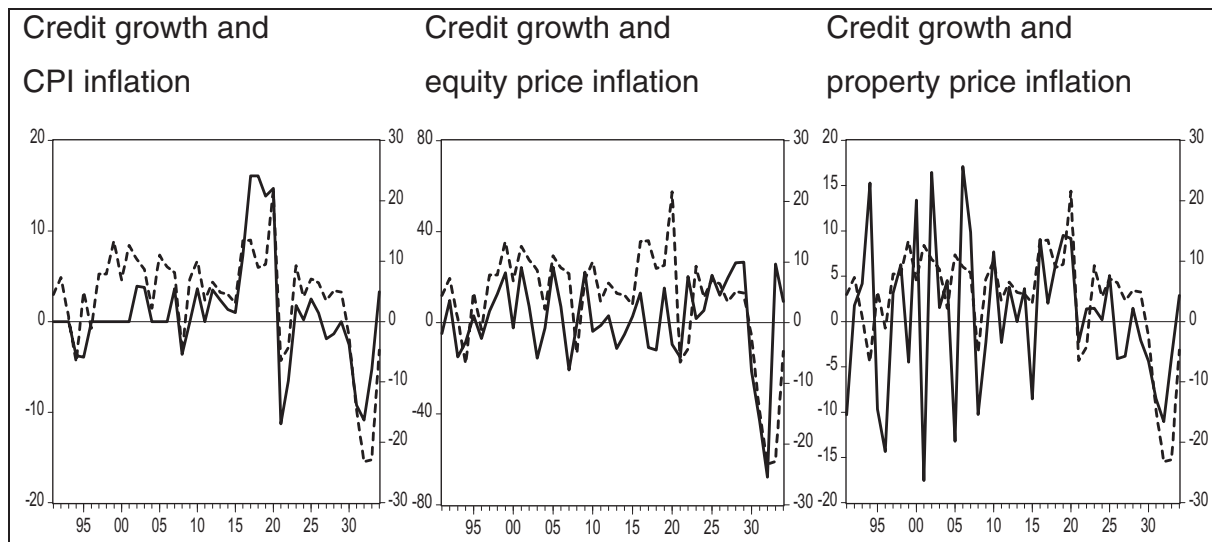
Source: Bureau of the Census (1960). The dotted line represents credit growth (right hand scale) and the solid line represents the rate of change in the respective price index (left hand scale).

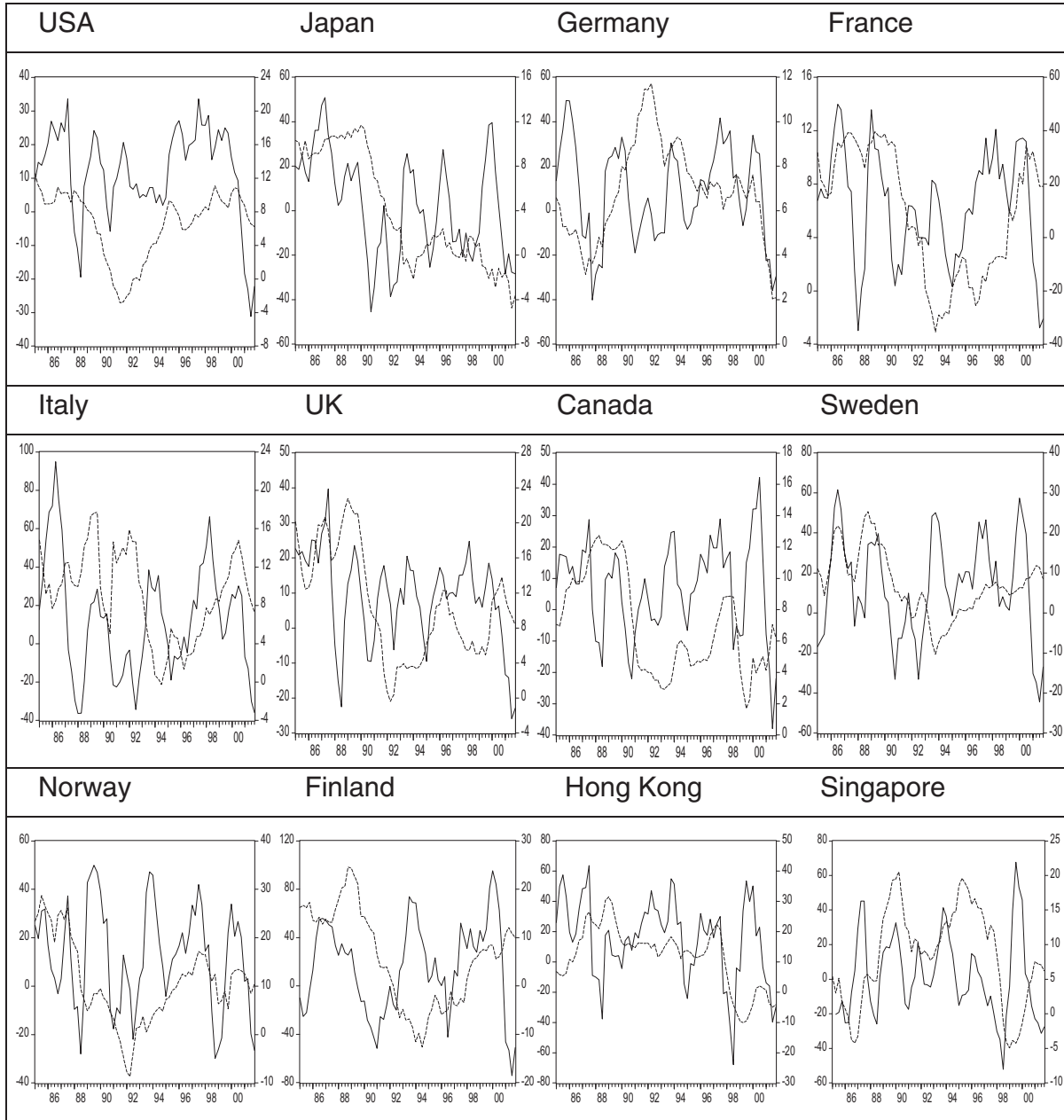Figure 3. Credit growth and CPI inflation 1985-2001
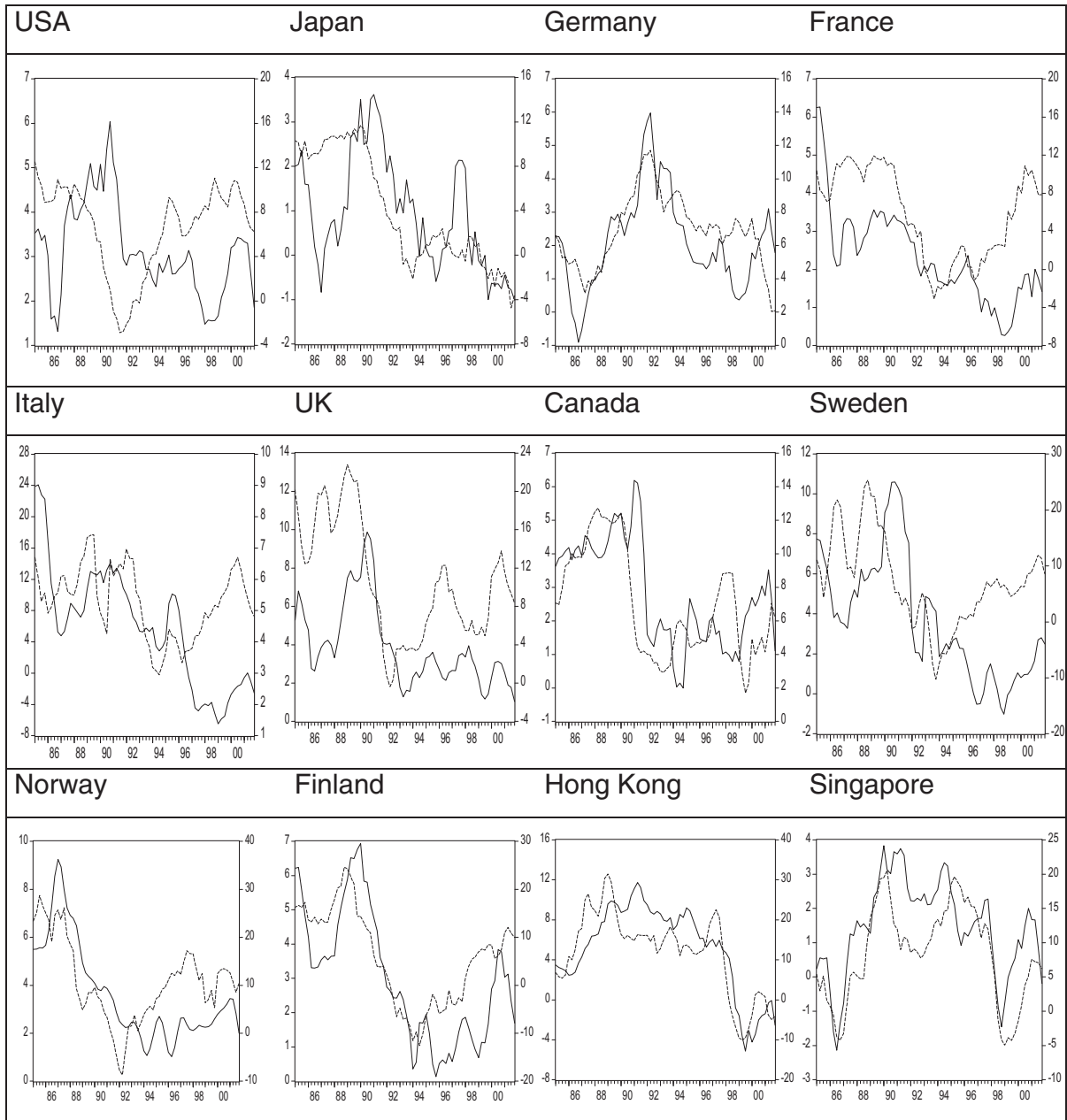
Sources: BIS, IMF, CEIC. The dotted line represents credit growth (right hand scale) and the solid line represents the rate of change in the consumer price index (left hand scale).

Figure 4. Credit growth and house price inflation
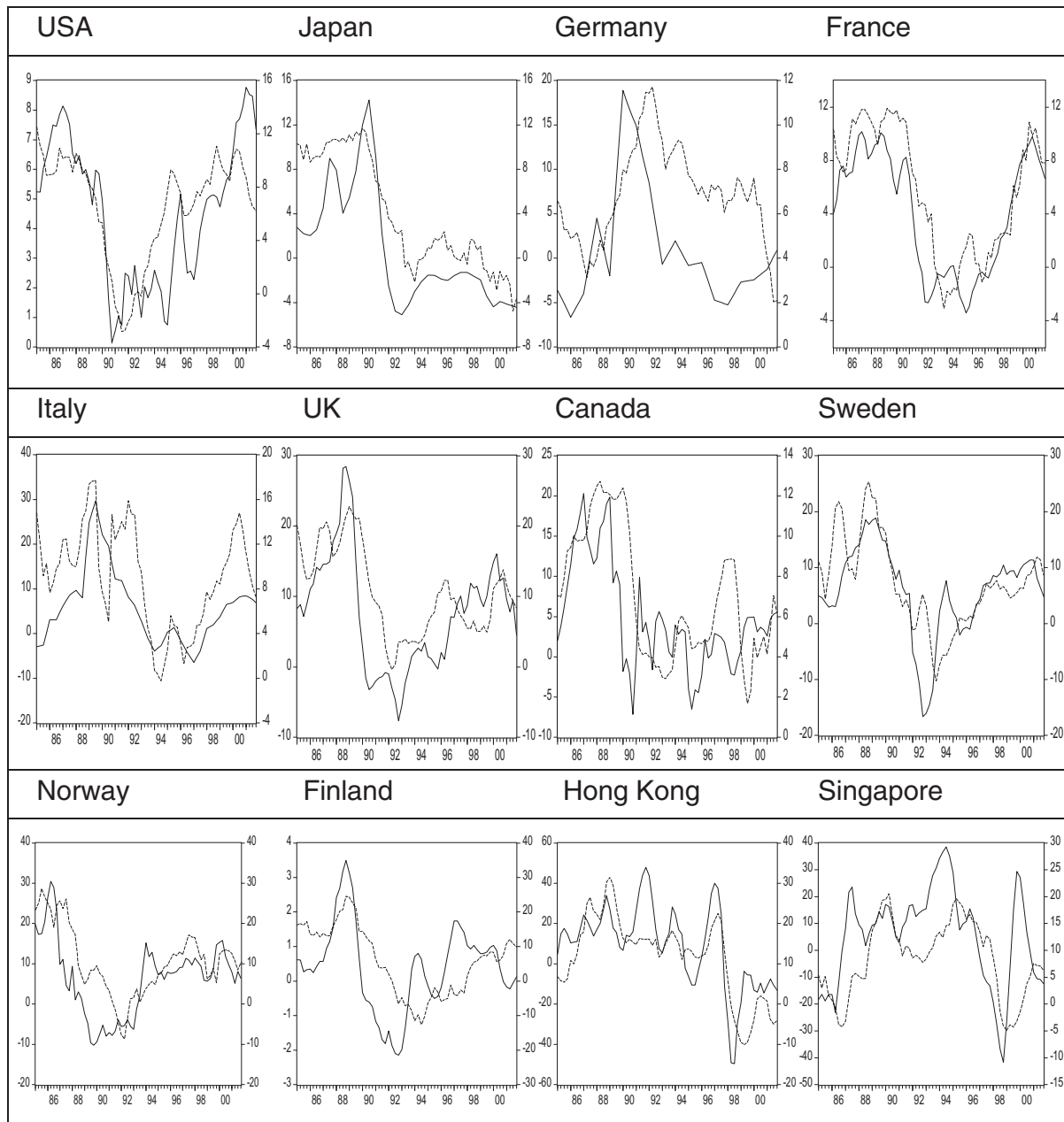
Sources: BIS, IMF, CEIC. The dotted line represents credit growth (right hand scale) and the solid line represents the rate of change in the residential house price index (left hand scale).

Figure 5. Credit growth and equity price inflation

Sources: BIS, IMF, CEIC. The dotted line represents credit growth (right hand scale) and the solid line represents the rate of change in the share price index (left hand scale).

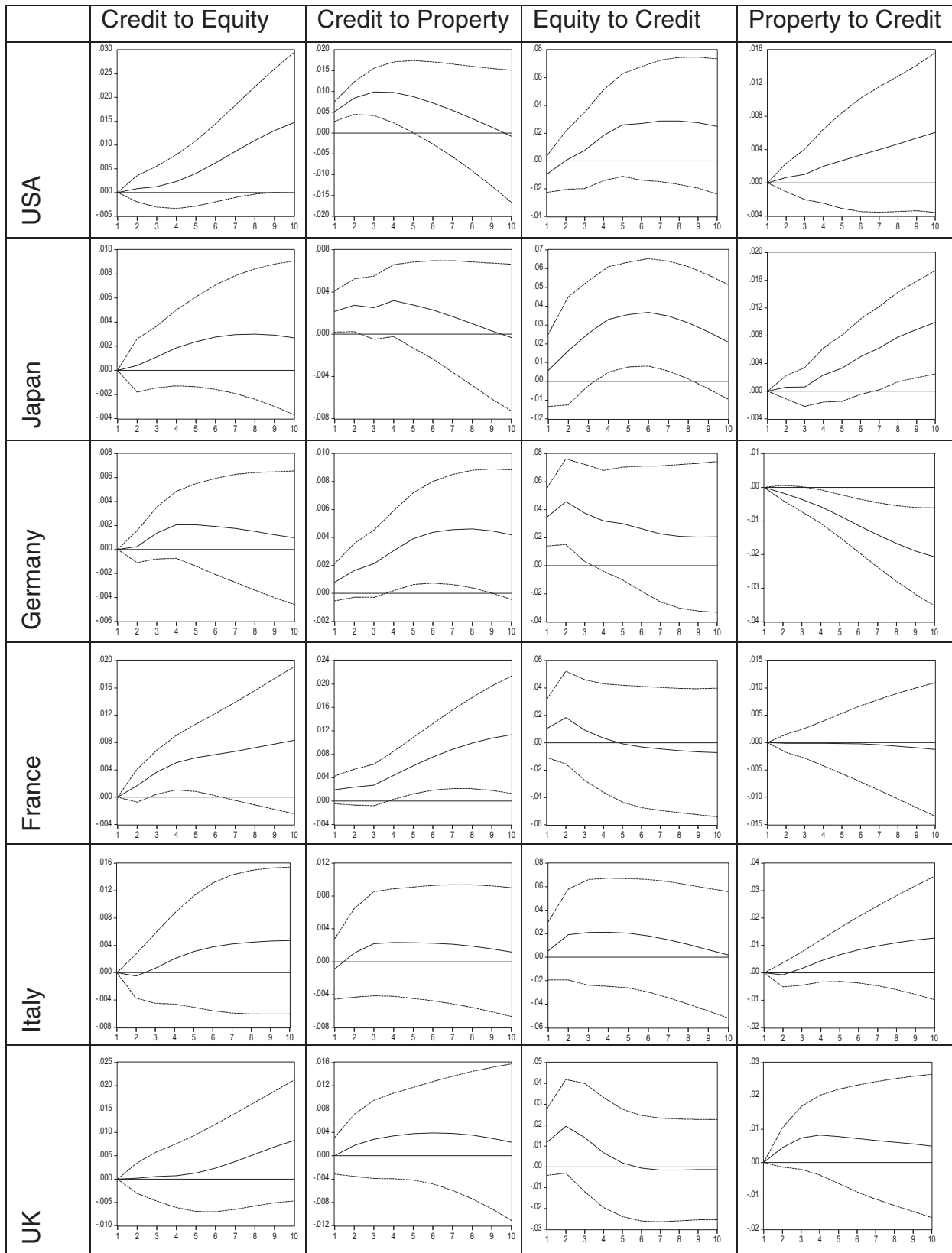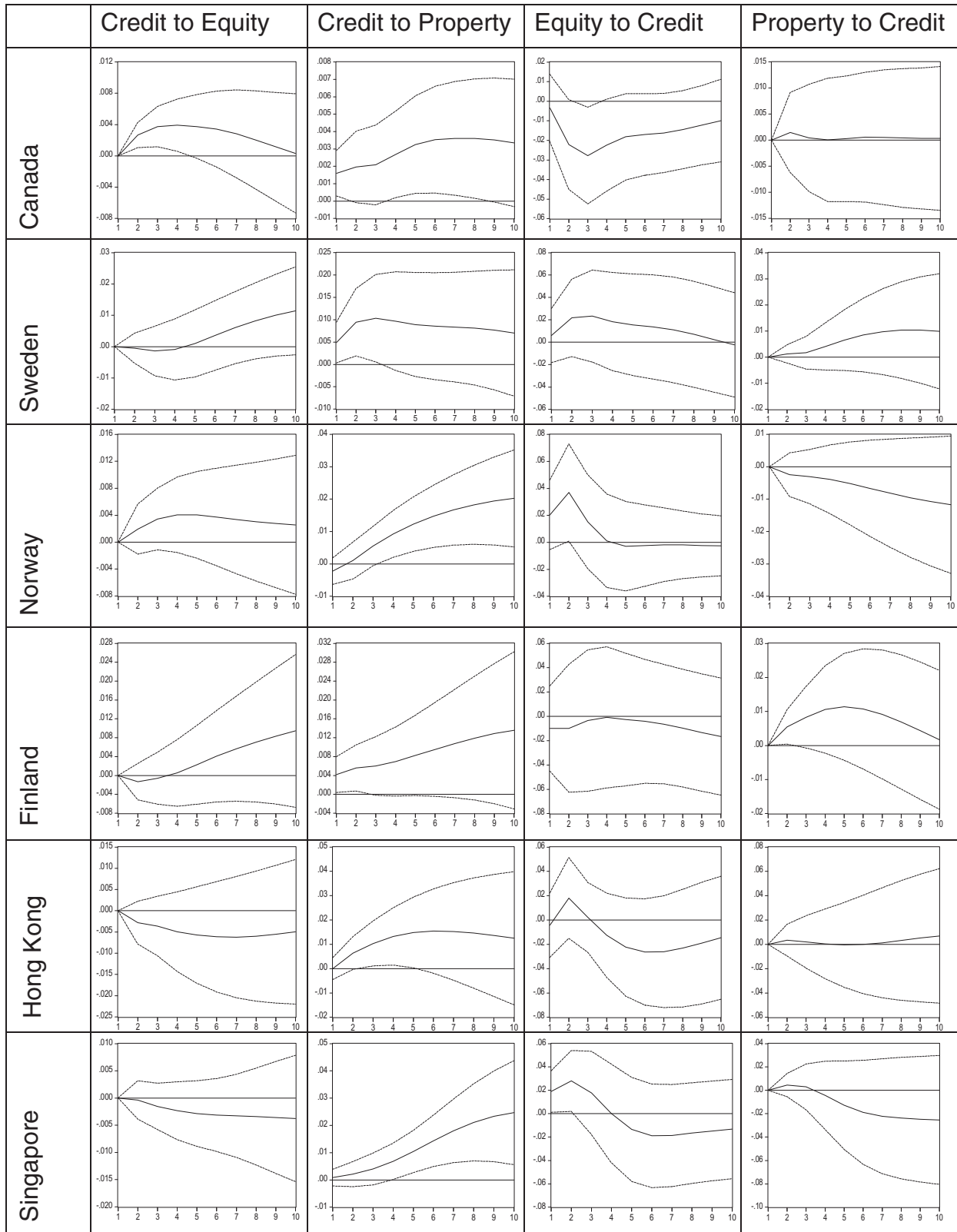Figure 6. Dynamic interaction between credit and asset prices

Figure 6. Dynamic interaction between credit and asset prices (continued)

Note: The figures display impulse responses to a one standard deviation shock in a two standard error confidence band.

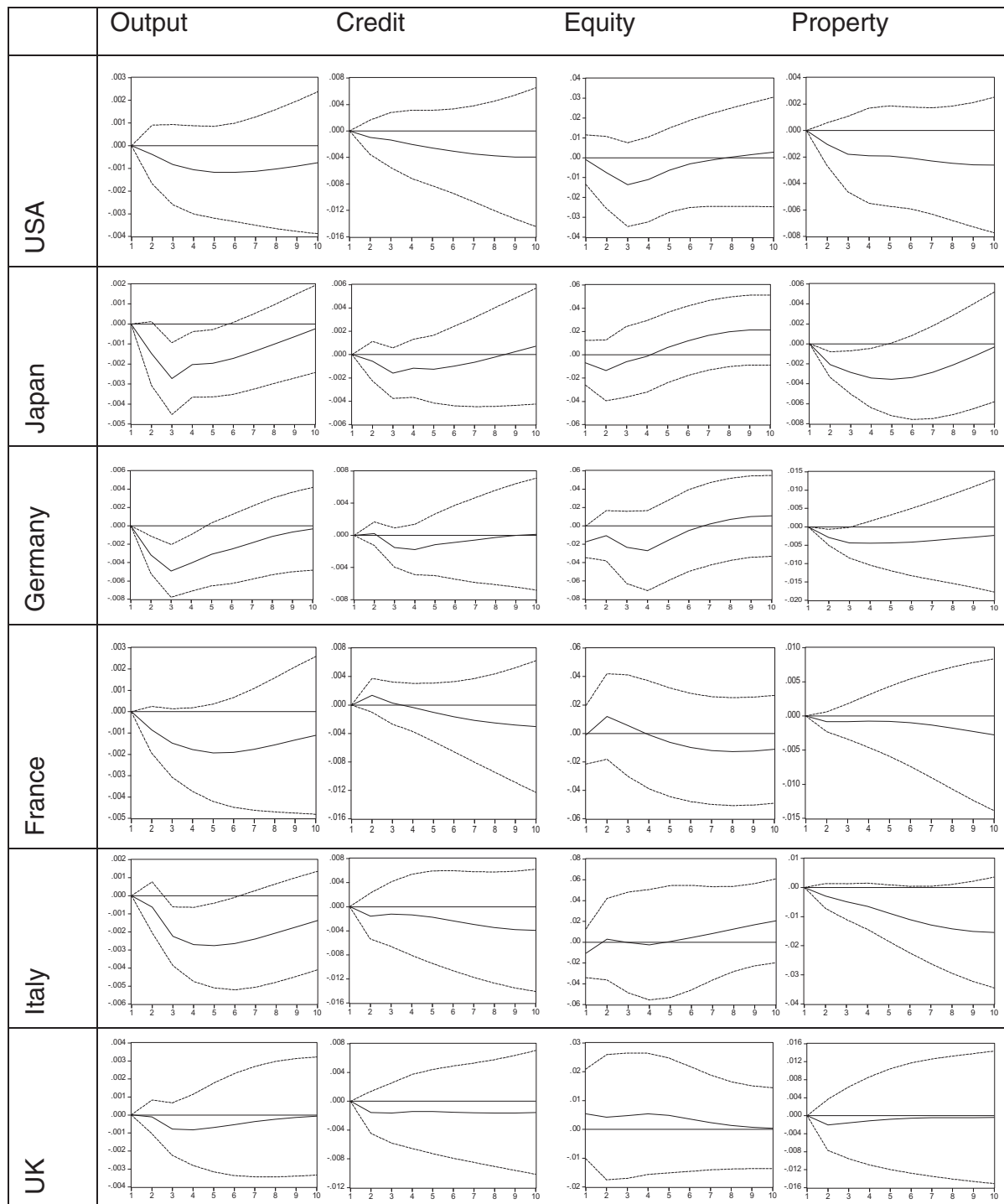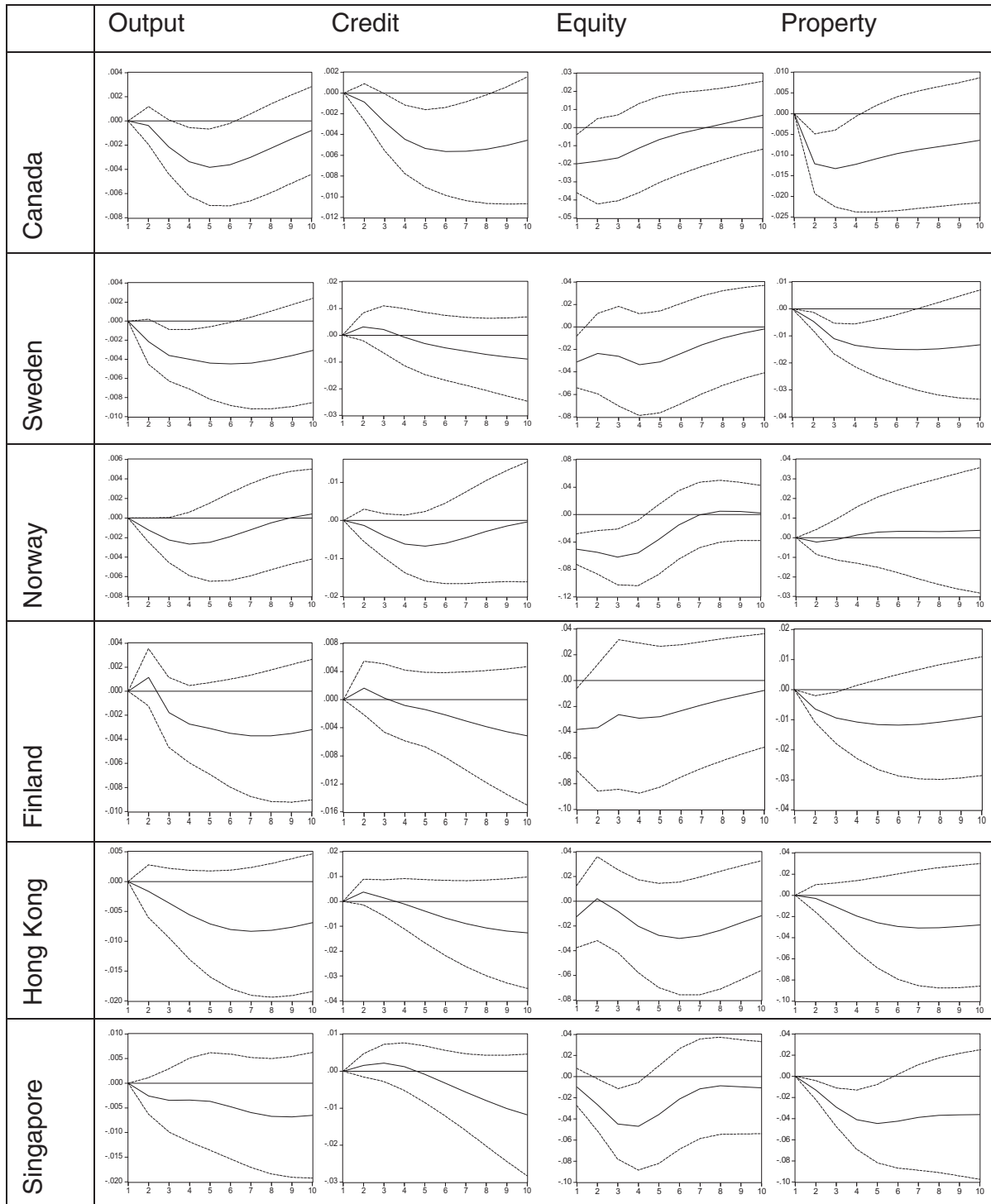Figure 7. The effect of a real interest rate innovation
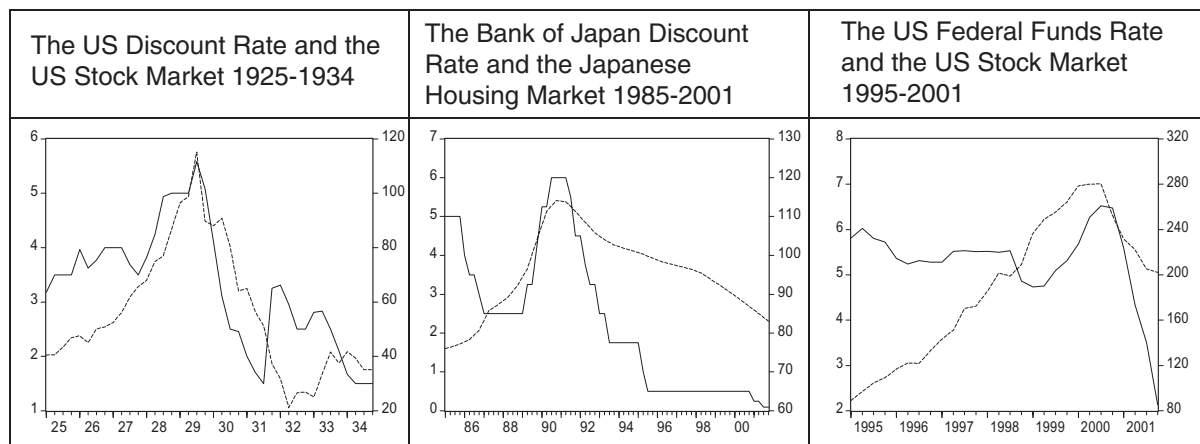
Figure 7. The effect of a real interest rate innovation (continued)

Note: The figures display impulse responses to a one standard deviation shock in a two standard error confidence band.

Figure 8. Monetary Policy and Asset Price Bubbles

| The US Discount Rate and the US Stock Market 1925-1934 | The Bank of Japan Discount Rate and the Japanese Housing Market 1985-2001 | The US Federal Funds Rate and the US Stock Market 1995-2001 |

Source: NBER Macro History Database, IMF, BIS, Japan Real Estate Institute

Appendix

	Residential Property Prices
Canada	Average house price index Source: Central Bank
Finland	National house price index Source: Central Bank
France	Residential house price index Source: Central Bank
Germany	Average sales price of owner occupied dwellings in Frankfurt, Munich, Hamburg and Berlin Source: Ring Deutscher Makler Note: Annual observations from the first quarter of each year converted to quarterly frequency by linear interpolation
Hong Kong	Residential property price index Source: CEIC
Italy	National house price index Source: Central Bank Note: Semi-annual observations converted to quarterly frequency by linear interpolation
Japan	Nation-wide residential land price index Source: Japan Real Estate Institute Note: Semi-annual observations converted to quarterly frequency by linear interpolation
Norway	Sales price index for one family houses Source: Central Bank
Singapore	Residential property price index Source: CEIC
Sweden	Single-family house price index Source: Central Bank
United Kingdom	All dwellings price index Source: Department of the Environment
United States	Single-family house price index Source: OFHEO and National Association of Realtors