

Asset Prices and Monetary Policy: A Canadian Perspective on the Issues

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The issue addressed in this article is the extent to which monetary policy in Canada should respond to asset-price bubbles. The article concludes that:

- Maintaining low and stable consumer price inflation should remain the primary goal of monetary policy. Accordingly, monetary policy decisions currently take into account the effects of asset-price movements on aggregate demand and inflation, tightening when rising asset prices stimulate aggregate demand and easing when a crash in asset prices depresses aggregate demand.*
- When asset prices rise rapidly, monetary policy might, in principle, better achieve its objectives of minimizing deviations of inflation from target and output from potential over time by allowing inflation to go temporarily below target in the short run. Such a step might reduce the risk that a crash in asset prices could lead to a recession and to inflation markedly below target in the longer run.*
- This strategy requires, however, that asset-price bubbles and their effect on the economy be identified with some precision. Such identification is rarely possible, since economists are far from being able to determine consistently and reliably when leaning against a particular bubble is likely to do more harm than good to the real economy.*
- Monetary policy should therefore aim for temporary deviations from its target only under rare and extreme circumstances.*
- Housing-price bubbles should be a greater concern for Canadian monetary policy than equity-price bubbles, since rising housing prices are more likely to reflect excessively easy domestic credit conditions than are equity prices, which are largely determined in global markets.*

The issue of how monetary policy should respond to asset prices gained prominence during the 1990s, following an increasing number of booms and busts in markets for equity and housing in many countries.¹ For example, Japan is only now slowly recovering from the asset-price bubble in equity and property markets that burst in the early 1990s. And, although nowhere near as dramatic, the United States experienced a shallow recession following the collapse of equity prices in 2000. This collapse, as well as other factors, such as the fallout from the terrorist attack on 11 September 2001 and concerns about corporate governance, contributed to slow the recovery. Currently, some commentators are questioning whether rising housing prices in the United Kingdom and Australia are a threat to future economic activity in those countries.

Given the pervasive and important channels through which asset prices affect economic behaviour and the aggregate economy, it should come as no surprise that monetary policy takes into account the impact of changes in asset prices on spending and inflation. The specific issue addressed in this article is whether monetary policy should respond to a special characteristic of asset prices, namely, asset-price bubbles.² These asset-price misalignments warrant separate consideration because they may have different consequences for spending than asset-price movements driven by

1. There are many important asset prices in the economy, but this article will focus on equity and housing prices. These prices are worth special attention, given their large share in the balance sheets of households and businesses and their historical tendency to experience episodes of large swings and misalignments (i.e., bubbles).

2. We use the terms “misalignment” and “bubble” interchangeably in reference to any large and persistent boom in asset prices that is followed by a bust and that is likely to entail an asset price deviating from its fundamental value.

fundamentals, owing to their episodic nature and possible non-linearities in behaviour.

This special characteristic of asset prices has generated arguments that, in the presence of potentially costly asset-price bubbles, monetary policy might better contribute to stabilizing output and inflation by raising rates (“leaning against the bubble”). The idea that monetary policy might respond to asset-price booms at the expense of temporary deviations from the inflation target is controversial. Much has been written on the subject in recent years. For example, the Federal Reserve Bank of Chicago, the Reserve Bank of Australia, and the European Central Bank all recently hosted conferences on asset-price bubbles.

The idea that monetary policy might respond to asset-price booms at the expense of temporary deviations from the inflation target is controversial.

The remainder of this article is organized as follows. The following two sections draw lessons from theories of why asset-price misalignments might occur and discuss the potential role of monetary policy in fueling asset-price misalignments. This is followed by a review of the reasons why asset-price bubbles might be costly and of the lessons to be learned from history. A discussion of the current role played by asset prices in Canadian monetary policy decisions follows. The discussion highlights the issues related to the identification of asset-price misalignments in real time, including some empirical examples for Canada. The article concludes with our views on how policy-makers might want to think about asset-price misalignments in the context of monetary policy discussions and suggests avenues for future research.

Asset-Price Bubbles: Causes and Effects

Equity and housing prices play an important role in the monetary policy transmission mechanism because they determine the value of wealth and because they

are responsive to interest rate movements. Asset prices also determine the value of collateral posted by households and firms to obtain loans from banks. Finally, housing prices enter into the calculation of the consumer price index (CPI) and so affect inflation directly.³ Given the importance of the indirect and direct channels through which asset prices affect economic behaviour and the aggregate economy, asset prices are one of the factors taken into account in the setting of monetary policy. The issue addressed in this article is whether monetary policy should respond to asset-price bubbles. To begin our exploration of this issue, we offer a brief review of the economic literature on the causes and consequences of asset-price bubbles.

In standard models of the economy, financial markets are assumed to be efficient and free of distortions. Economic agents are assumed to exhibit “rational” (optimizing) behaviour. Asset-price misalignments are not possible unless economic agents exogenously deviate from their optimal behaviours. Moreover, should misalignments somehow arise in these models, they would be quickly eliminated by well-informed arbitrageurs (Fama 1965).⁴

The real world appears to deviate from the standard economic model, since history is rife with examples of apparent misalignments in housing and equity markets. In reviews of the theoretical literature, bubbles are generally classified by the behaviour that contributes to their formation, as well as by the efficiency of the markets in which they occur. However, not all theories fall neatly into these categories.

One branch of theory posits that bubbles can be caused by investors acting on irrational or erroneous beliefs. These beliefs are owing to fads or overly optimistic agents. In this framework, an asset-price bubble could occur because of exaggerated confidence in the fundamentals underlying the asset (a new technology or organizational structure, for example) to generate

3. Housing prices are incorporated in the “owned accommodation” component of the CPI, which is itself a weighted average of indexes of price elements of homeowners’ costs. For details, see Canada (1989).

4. In a small class of models, bubbles continue because of “rational” self-fulfilling expectations where an investor purchases an asset solely in anticipation of selling it at a higher price to someone willing to purchase the asset for the same reason (Blanchard and Watson 1982; Santos and Woodford 1997). These models do not explain the start or end of bubbles, nor are they supported by the data.

future earnings (Meltzer 2003).⁵ Perhaps the most notorious real-world example of this is the “irrational exuberance” explanation for the rise in equity prices in the United States in the second half of the 1990s (Greenspan 1996). This explanation emphasizes the excessive optimism stemming from positive developments in the real side of the economy that contribute to the underestimation of risk and the overextension of credit. The resulting excessive rise in asset prices leads to overinvestment in physical capital and buoyant consumer expenditures that feed back into the real economy, amplifying the cycle. Collins and Senhadji (2003) describe how this cycle might also develop in the real estate market.

In a second branch of theory, misalignments are explained by rational reactions to unexplained real-world constraints on economic behaviour. For instance, informational frictions may cause herding behaviour, in which a large number of individuals react the same way to new information, thereby creating an overreaction in aggregate. They might react in this way—in full knowledge that there is likely to be an aggregate overreaction to the news—because they would suffer reputational damage if they did not react like their competitors or because they are compensated relative to a benchmark based on aggregate behaviour and therefore find it too costly to “buck the trend.”⁶ Another example is given by Allen and Gale (2003), where banks have insufficient information about the investment intentions of borrowers and therefore underprice risk in loans to investors, thus providing excess credit that fuels the bubble.

In theory, there are many reasons why bubbles can persist despite the presence of rational arbitrageurs who are collectively both well informed and well financed. In virtually all of these theories, the force behind the persistence of the bubble is rational arbitrageurs who try to ride the bubble for as long as they can (even though they know it will eventually collapse) to generate high returns. What the different theories try to explain is why too few arbitrageurs “bet against the market,” thereby bringing the bubble to an abrupt end. Abreu and Brunnermeier (2003) provide one such explanation. They posit that bubbles persist in a world of well-informed and well-financed arbitrageurs

because different arbitrageurs use different methods for timing the market. This diffusion of exit strategies and the resulting lack of synchronization permit the bubble to persist until a sufficient mass of traders sells out.

It [is] difficult for policy-makers to know in which direction to react to an asset-price misalignment: whether to tighten in order to lean against the growing bubble or to ease, in anticipation of the aftermath of the bursting bubble.

In all economic models, asset-price misalignments are introduced into the model by some combination of exogenous element or exogenous modification to behaviour. The exogenous explanation for asset-price misalignments in these models has important implications for monetary policy. First, it means that the start, length, and end of an asset-price bubble, as well as how the bubble will react to a change in monetary policy, will all have an unpredictable element because the misalignment is not fully explained by the economic model. This unpredictability makes it difficult for policy-makers to know in which direction to react to an asset-price misalignment: whether to tighten in order to lean against the growing bubble or to ease, in anticipation of the aftermath of the bursting bubble. Second, changes in monetary policy may have unpredictable non-linear effects on the behaviours that are generating the bubble, since investors may be behaving in an economically “irrational” way that is not susceptible to the influence of the economic incentives generated by a small rise in the policy rate. This line of reasoning supports Bernanke’s (2002) and Greenspan’s (2004) view that the instruments of monetary policy are too blunt to be used effectively for controlling asset-price bubbles. Finally, actions to improve the efficiency of markets and reduce information asymmetries would be beneficial in reducing the probability of a bubble persisting.⁷

5. Meltzer refers to these irrational bubbles as “Kindleberger manias.” See Kindleberger (1978).

6. See Bikhchandani and Sharma (2000) for an excellent review of this literature.

7. See Hendry and King (2004) for a discussion of market efficiency in Canada.

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How Monetary Policy Can Make a Bubble More Likely

Some economists have proposed that a monetary policy regime that targets low and stable inflation can increase the probability of asset-price bubbles forming because the stability associated with inflation targeting can fuel excessive optimism about the future profit potential of new technology. Other economists think that an inflation-targeting regime reduces the likelihood of asset-price bubbles, but that inappropriate implementation of monetary policy within that regime can contribute to the formation of a bubble. These suppositions have arisen in part because of evidence that asset-price swings have been greater in recent business cycles than in previous business cycles, despite the success of many countries in attaining a low-inflation environment (Borio and White 2004).

Eichengreen and Tong (2003) study a century's worth of data from 12 countries (including Canada) and show that asset-price volatility is highly correlated with volatility in the monetary policy regime. Asset prices are less volatile in stable monetary regimes, such as those that target inflation, and hence the probability of a bubble in those regimes is lower. The increase in asset-price misalignments in low-inflation countries in recent years may therefore be the result of positive technology (rather than monetary) shocks, which, because of their uneven and uncertain effect on production possibilities, have an effect on revenue streams that is difficult for investors to predict.

But bubbles can occur even in stable monetary policy regimes when credit is easily available. A long list of empirical studies have found a correlation between excessive credit growth and asset-price bubbles. For example, Bordo and Jeanne (2002) examined post-1970 data for stock and property prices from 15 countries that are members of the Organisation for Economic Co-operation and Development (OECD) and observed

that credit growth was unusually strong during the 20 asset-price booms reflected in these data. In a similar study using aggregate asset-price data from 18 OECD countries since the 1970s, Detken and Smets (2003) found that, where real money and credit growth were particularly strong, high-cost asset-price busts have tended to follow asset-price booms. Borio and Lowe (2003), in a study of 34 countries from 1960–99, also found that excess credit and asset-price cycles often occur in tandem.

These correlations may reflect errors in monetary policy that arise because asset-price bubbles are typically excluded from the models used for monetary policy advice. It may be that, in some circumstances, monetary policy does not give sufficient weight to the consequences of excessive credit growth, and so policy remains easy for too long, thereby creating a credit cycle that contributes to a boom-bust cycle in asset prices. This may happen at a time when the inflation target is highly credible, such that excess demand pressures show up first in asset prices rather than in inflation expectations or in the prices of consumer goods and services, delaying the reaction of inflation to excess demand pressures. If monetary policy advisers are unaware that the boom in asset prices reflects building excess demand pressures, monetary policy may inadvertently remain easy, contributing to the credit growth that fuels an asset-price bubble.

In our view, an inflation-targeting regime is the best monetary policy regime for reducing the probability that asset-price bubbles will develop in the first place. Inflation targeting provides a stable environment in which nominal profits are easier to predict, thus improving the ability of rational arbitrageurs to estimate the fundamental price of assets. In fact, changes in housing and equity prices in Canada have been historically highly and positively correlated with the output gap, which is a key indicator used by the Bank of Canada in setting monetary policy (Charts 1 and 2).

Why Some Asset-Price Bubbles Are Costly When They Burst

Asset-price bubbles are not always costly when they burst but, occasionally, a bursting bubble can be associated with events that are very disruptive to the real economy. The Great Depression and, more recently, the situations in Japan and the United States demonstrate just how large the costs associated with a burst-

Chart 1
Change in Real Property Prices and the Output Gap for Canada

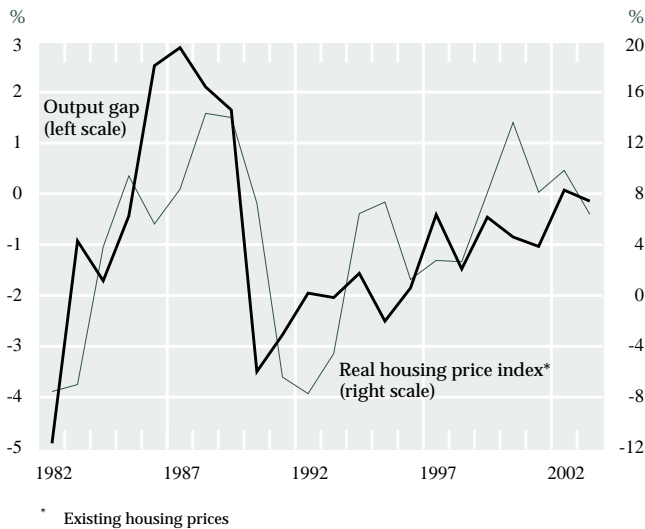
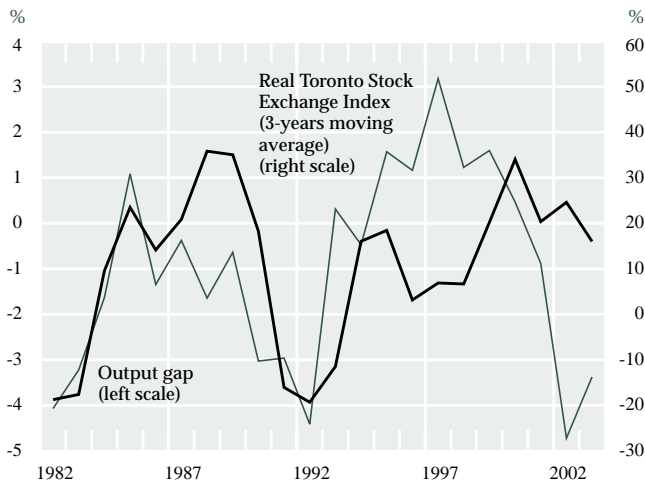


Chart 2
Change in Real Equity Prices and the Output Gap for Canada



ing asset-price bubble can be. While Canada has few examples, the aftermath of its commercial and residential property boom and bust in the early 1990s involved long and painful adjustments on both the real and financial sides of the economy.

Asset-price booms can be costly for many reasons. Equity-price bubbles inappropriately reduce the cost of equity finance, which can cause overinvestment in real capital. Housing-price bubbles give home buyers a false sense of the real return they can expect on their investment, which can lead to speculative home buying and overinvestment in the real housing stock. This can lead to overinvestment in physical capital, overconsumption, and overextension of credit. And, although this overspending usually reverses when the bubble bursts, at a minimum, the timing of spending is affected, thereby increasing output volatility.

A decline in asset prices results in a deterioration in balance sheets that constrains spending and investment. Falling asset prices lower the value of collateral, which reduces the willingness of financial institutions to lend. This can cause decreased spending on investment and consumption goods and increased bankruptcies. Rapidly declining asset prices can undermine investor confidence by increasing uncertainty about the future—another reason for reduced spending and investment.

Although it is easy to describe the channels through which a bubble can impose costs on the economy, actually estimating these costs is not easy, because the endogeneity and forward-looking nature of asset prices make it difficult to determine how the economy would have been different had asset prices not behaved as they did. Moreover, each episode of boom-bust in asset prices is unique, making summary statistics and “stylized facts” of limited use in predicting the future. At the same time, we believe that a few lessons can be drawn from studies that use multi-country analyses of boom-bust cycles in housing and equity markets.

These lessons are:

1. *Not all asset-price booms result in busts* (Bordo and Jeanne 2002; Helbling and Terrones 2003). The results of these studies, among others with similar conclusions, mean that not all bubbles end with a crash or end in a costly manner. As a result, knowing that a bubble is forming, in and of itself, is not sufficient justification for a policy response to the bubble.
2. *Housing-price bubbles are more likely to end in busts and to be costly.* Helbling and Terrones (2003), for example, find that only 25 per cent of the equity-price booms in the past 30 years ended in busts, while around 50 per cent of the housing-price

booms ended in busts. Housing-price busts are correlated with larger output losses than are equity-price busts and are drawn out over a longer period (4 years vs. 1.5 years). The evidence for Canada, based on how different types of wealth affect consumption, suggests that housing-price bubbles are more likely to be costly than are equity-price bubbles.⁸ Housing-price bubbles may also present a greater threat to the financial stability of the economy, given that the banking sector of an economy tends to be more exposed to loans secured by real estate. Eichelgreen and Bordo (2002) found that virtually all episodes of banking stress in their data were accompanied by housing-price busts.

3. *Asset-price busts seem to be more costly when they occur in financial systems that are not well regulated* (Hunter, Kaufman, and Pomerleano 2003). Not surprisingly, economies with financial systems that have strong supervisory and regulatory institutions, as does Canada, tend to weather a bubble's collapse better than economies with fragile financial systems.

Overall, the stylized facts from a wide range of empirical studies suggest that policy analysts should not assume that all asset-price bubbles will be costly when they burst. The uncertainty about how policy should respond to an asset-price bubble is even greater because the timing of the end of a bubble is uncertain. Should policy-makers raise rates to lean against the bubble or lower rates to mitigate the costs associated with the bubble bursting? The fickle nature of bubbles suggests that there is much potential for an activist policy-maker to get the timing wrong, thereby making matters worse (Laidler 2004; Stockton 2003). The evidence suggests that policy-makers should monitor asset-price bubbles closely and react only when they are sufficiently certain that their reaction will do more good than harm to the economy. They should also be cognizant of the stylized fact that bubbles in housing prices are more worrisome than those in equity prices, in part because housing prices tend to reflect domestic credit conditions, whereas equity prices tend to reflect global forces.

8. See Pichette (2004) for a review of wealth effects in Canada. Recent estimates by Pichette and Tremblay (2003) find an average marginal propensity to consume (MPC) from housing wealth of 5.7 cents per dollar. This is much greater than their statistically insignificant estimate of the MPC from stock market wealth of less than one cent per dollar. This is consistent with Case, Shiller, and Quigley (2001), who find strong evidence across 14 countries (including Canada and the United States) that variations in housing wealth have an important effect on consumption, but only weak evidence that stock market wealth affects consumption.

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How Asset Prices Currently Enter Policy Analysis

Policy analysts at the Bank of Canada incorporate movements in asset prices into their analysis in many ways. First, fundamental asset-price values are implicit in the calculations that determine the value of wealth in the main structural model used for policy advice and through their direct effect on the CPI.⁹ Second, indicator and monitoring models that use market-determined asset prices are being developed for policy advice.¹⁰ Third, descriptions and analysis of the evolution of market-determined asset prices are included in the regular briefings to policy-makers that precede policy decisions.¹¹

In the Bank's main policy model, the Quarterly Projection Model (QPM), wealth is valued at what can be considered to represent fundamental prices (i.e., prices that reflect the underlying long-term value of an asset rather than the current price). Since wealth is a determinant of consumption in the model, the dynamics of consumption are tied to the fundamental value of assets (Coletti et al. 1996).¹² The QPM implicitly incorporates estimates of the long-run (fundamental) value of asset prices when calculating the steady-state value

9. For a review of these models, see Coletti and Murchison (2002). In particular, housing prices are incorporated into several components of Canadian core CPI, and therefore, direct effects are taken into account in structural policy models.

10. Current reduced-form models in use at the Bank do not incorporate asset-price misalignments. However, reduced-form models are being developed (Gauthier and Li 2004) that should result in asset-price misalignments being better understood.

11. See Macklem (2002) for details of the information used in monetary policy decisions.

12. The principal measure of wealth corresponds to Macklem's (1994) consolidated concept, where households are the ultimate owners of private sector wealth.

of capital (Black et al. 1994).¹³ Since the steady-state value of capital is a determinant of investment in the model, shocks to these fundamentals (e.g., technology shocks) have implications for supply and demand in the economy, and hence, have implications for short-term growth and inflation (Coletti et al. 1996).

Missing from these models are the effects of changes in market-determined asset prices that do not reflect fundamentals—asset-price misalignments—and that may be perceived as persistent and important by economic agents. Also missing are the effects that asset-price misalignments may have on the ability of households and firms to obtain credit, since asset prices also determine the value of collateral posted by households and firms.¹⁴ The importance of these effects is ultimately an empirical question and depends in large part on how economic agents perceive asset-price changes (persistent and to be incorporated into economic decisions or transitory and to be ignored) and on the ability of households and businesses to use their portfolios as collateral. It might also be expected that the magnitude of these effects would vary with the financial structure of the economy. While not much empirical work for Canada has focused on this question, recent evidence suggests that property prices are positively correlated with the availability of household credit across countries (including Canada), pointing to an active credit channel (Hofmann 2001). The importance of this channel in Canada and the United States may have grown in recent years with the advent of home-equity financing.¹⁵ It might also be expected that the unique characteristics of the credit channel would be more prominent and therefore more relevant to monetary policy in the presence of large asset-price misalignments.

If fluctuations in asset prices contain reliable leading information about gross domestic product (GDP) and/or inflation, then they should be included in the information set considered by policy-makers.¹⁶ Unfortu-

nately, for Canada as for most countries, the empirical evidence suggests that the information content of asset prices in general, and of equity and housing prices in particular, is unreliable in that they do not systematically predict future economic activity. In particular, Stock and Watson (2003) find that just because a predictor worked well in one period does not mean that it will work well in the next. In other words, they found no subset of predictors, horizons, or variables in which the relationship between asset prices and real economic activity was stable enough to be used for policy analysis. This said, the analysis in Stock and Watson is restricted to simple linear relationships that do not pick up the potential non-linear effects of asset-price misalignments. Work on a financial conditions index (FCI) for Canada that allows more complex interactions between variables and includes housing and equity prices does provide some leading information for output at some time horizons, although not for inflation (Gauthier, Graham, and Liu 2004).¹⁷

The discouraging results obtained with indicator models led Gilchrist and Leahy (2002), among others, to suggest that movements in asset prices should be evaluated in structural-behavioural models that are explicit about their causal or structural relationship to economic activity.¹⁸ Theory and evidence also suggest that asset-price misalignments are likely to have different empirical properties than asset-price fluctuations corresponding to changes in fundamentals and therefore should be treated differently by monetary policy-makers (Filardo 2001). This suggestion represents an interesting avenue for future research on the relationship between asset prices and real economic activity.

Identifying Bubbles: A Canadian Example

Probably the reason most frequently cited for not responding to asset-price bubbles is the difficulty of identifying bubbles *ex ante* (or even *ex post*). The

13. This follows from the neo-classical theory of investment, where the long-run desired capital stock is a function of the equilibrium level of real output and the real user cost of capital (derived from the solution of a multi-period profit-maximization problem of a representative firm).

14. Asymmetric information gives rise to adverse-selection and moral-hazard problems. In this case, banks require borrowers to offer collateral to back a loan (Bernanke, Gertler, and Gilchrist 1999).

15. The advent of home-equity loans has also offset the fact that housing wealth is less liquid than stock market wealth and subject to higher transactions costs.

16. This could be achieved through the use of indicator models, which systematically extract the leading information of variables.

17. Predictive instability is not inconsistent with the findings of some researchers that housing and equity prices contain useful information about future economic activity in some periods for some countries. For example, Goodhart and Hofmann (2000) find that housing prices have leading indicator properties for inflation in 12 countries, although Cecchetti et al. (2000) and Filardo (2001) show that the inclusion of housing prices does not improve inflation forecasts in an economically significant manner.

18. The authors refer to arguments made by Woodford (1994) that poor forecasting performance of an indicator may be expected if policy-makers use this information and respond to it.

difficulty arises in large part because, as Richards (2003) points out, any operational definition of an asset-price bubble is highly subjective. The subjectivity arises largely from two sources. First, an asset-price bubble is often defined as a major deviation of an asset price from its fundamental value, and there are many different yet legitimate ways to think about fundamental value. Second, how far and how long an asset price must move away from its fundamental value before it is considered a bubble is also highly subjective.

In practice, current techniques for identification do not identify misalignments precisely enough for policy purposes, as is demonstrated by the following example using Canadian stock market data from the Toronto Stock Exchange (TSX). In this example, two measures of the stock market gap (the difference between actual fundamental price and estimates of it) are compared. The measures shown here have both advantages and drawbacks, but are nonetheless illustrative.¹⁹

The first estimate is drawn from the standard-valuation approach, which is perhaps the approach most widely used by market analysts and economic researchers alike, largely because of its simplicity. The well-known Federal Reserve (FED) model is a forward-looking version of this type of model that compares the earnings yield to the bond yield. Using forward earnings is more relevant for stock valuation, especially around turning points in the business cycles. The model measures the fair value of a stock market index as expected earnings divided by the yield on 10-year Treasury bonds. The ratio of the current stock index to the fair-value price shows the degree of over- or undervaluation.²⁰

The second estimate is based on an estimate of the fundamental value of equity prices from a macroeconomic model (BEAM) developed at the Bank of Canada that identifies the long-run determinants of the TSX (Gauthier and Li 2004). The resulting relationship is often referred to as a cointegrating vector because it

identifies the common stochastic trend in the asset price and common macroeconomic variables such as output and inflation.²¹ The key cointegrating vector in the empirical model is one that relates the log of the stock price index to the log of nominal GDP with a coefficient of one, which means that the fundamental value of stock prices grows at the same rate as nominal GDP in the long run. This approach to determining fundamental values has the appeal of being linked directly to macroeconomic theory. It also uses econometric estimates rather than arbitrary exogenous assumptions about the future path of revenue streams and discount rates to determine fundamental values.²²

The estimates in Chart 3 show that measures of asset-price misalignments are highly variable, not very correlated, and often send conflicting signals. When specific episodes are examined, the measures send mixed signals about the degree of price misalignment at critical times for policy analysis. For example, during the period leading up to the stock market decline of October 1987, only the Fed model would have sent consistently worrisome signals (Chart 4). Moreover, by the time the signals emerged, tighter policy to lean against the bubble would have had contractionary effects following its collapse.

This is consistent with Japanese evidence using real-time data, which shows that Japan's asset bubble could not have been predicted with sufficient precision to allow monetary policy to respond pre-emptively (Okina and Shiratsuka 2003). It also supports Bean's (2003) view that by the time enough data were available for policy-makers to be confident that an asset-price bubble had indeed emerged, it would likely be too late for policy to react pre-emptively to the bubble in order to avoid economic disruption.

19. Since all existing measures of equity-price misalignments have important drawbacks, one should not rely on a single measure. See Bank of Canada (2004) and Hannah (2000) for applications of other stock market valuation techniques to Canadian data.

20. The Fed model is based on the strong correlation between the forward-earnings yield of the S&P500 SX and the Treasury yield. Our use of a Canadian version of the Fed model presumes the same empirical regularity in the Canadian data as in the U.S. data. The Fed model also uses nominal rather than real rates of return, even though theory posits that the earnings yield should equal the real bond yield plus a risk premium. And the Fed model takes the bond yield as exogenous, even though it must adjust to the expected rate of return on capital in the long run. These drawbacks reduce, but do not eliminate, the usefulness of this approach.

21. In this model, the fundamental value is defined as the accumulation of permanent shocks to asset prices. The permanent component of every variable is estimated in the vector-error-correction model (including stock prices) using the identification methodology suggested in King et al. (1991). This allows the construction of a stock market gap that is defined as the difference between stock prices and their permanent component. The gap is therefore the transitory component of the stock market which, by definition, should not last.

22. The weakness of the approach is that there is no guarantee that the macroeconomic variables identified in the cointegrating vector are, in fact, linked to the future revenue stream of the asset or to future discount rates. Another weakness relates to the technical point that cointegrating vectors are often non-unique.

Chart 3

Alternative Measures of Asset-Price Misalignments (TSX)

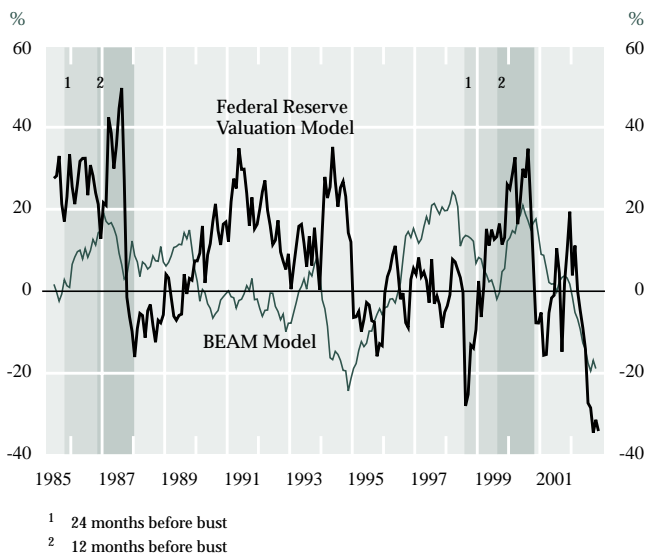
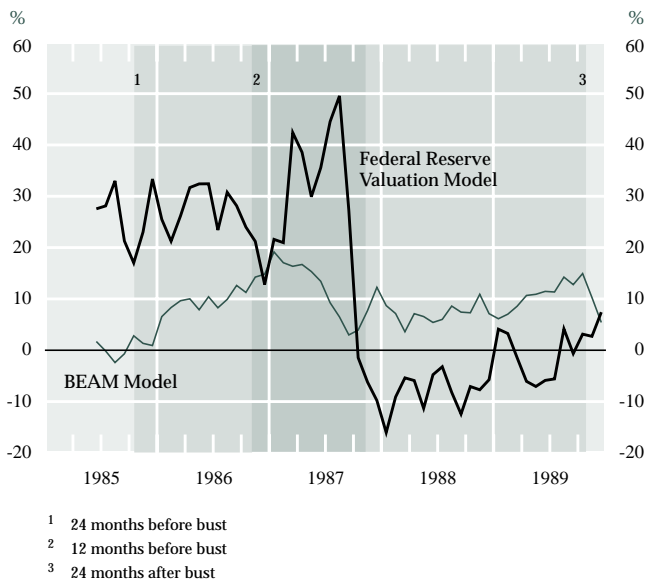


Chart 4

Alternative Measures of Asset-Price Misalignments (TSX), October 1987



What Might Monetary Policy Do?

Our view of the evidence and the literature is that asset-price misalignments can pose important risks to the economy, particularly if they are accompanied by financial fragility and occur in the housing market. In and of itself this is a compelling reason for monetary policy to pay special attention to asset-price misalignments. As discussed earlier, the Bank of Canada currently incorporates movements in asset prices into policy analysis in many ways, so that monetary policy reacts to these movements to the extent that they have an impact on the projected path of the output gap and inflation over the target horizon of two years.

In the case of a large misalignment in asset prices, however, monetary policy objectives may be better achieved, at least in principle, if monetary policy were to lean against the misalignment at the expense of inflation returning to target over a slightly longer horizon.²³ In this regard, housing-price misalignments are more of a concern than equity-price misalignments, since housing prices are more sensitive to domestic credit conditions than are equity prices, which are largely priced in global markets.²⁴

In practice, the case made to take such extraordinary action should have a high burden of proof, for two reasons. First, the analysis is partial, and the full consequences of any policy reaction will be unknown, given that asset-price misalignments are excluded from policy models. Second, the burden of proof should be high because of the uncertainty surrounding estimates of the size, timing, and costs of asset-price bubbles. The analysis should therefore strongly indicate that a bubble does indeed exist, that it will probably be costly when it bursts, and that the bursting is likely to be far enough into the future that policy does not run the risk of making matters worse by effecting a tightening on the economy simultaneously with the bubble bursting. The high burden of proof is

23. This would be the case if leaning against an asset-price bubble were successful in either restraining its size and/or limiting the overspending and financial imbalances in balance sheets and credit markets that tend to accompany asset-price booms. In this case, the costs of the unwinding of the asset-price boom in terms of output losses and undershooting of inflation from its target would be lower.

24. This view implies a symmetrical monetary policy response in which monetary policy leans against asset-price bubbles and leans into asset-price bursts. Some commentators have suggested that monetary policy should respond asymmetrically by ignoring asset-price bubbles while easing in response to asset-price bursts. The disadvantage of the asymmetrical approach is that asset buyers are less likely to show restraint during a bubble if they believe that monetary policy will be asymmetrical.

also essential to maintain clear communication of policy actions and policy credibility.

It is our view that this burden of proof would rarely be met. First, bubbles are difficult—though not impossible—to identify in real time. Second, it is very difficult to predict when a bubble will burst, given that economic theory has difficulty explaining why bubbles start, persist, or end. Third, it is very difficult to determine whether a bubble will be costly on bursting, given how little we know about bubbles. Thus, economists are far from being able to determine consistently and reliably when leaning against a particular bubble is likely to do more harm than good to the real economy. For these reasons, inflation targeting remains the best contribution that monetary policy can make to promoting economic and financial stability.

The main thrust of the Bank's research in this area will be to learn more about the relationship between fluctuations in housing and equity prices and economic activity in Canada, as well as how monetary policy interacts with these fluctuations. This will require the development of theoretical and empirical tools that model structural relationships. This is consistent with Friedman's (2003) view that monetary policy should

react to asset-price bubbles only if there is a role for them in a fully thought-out model of the transmission mechanism.

Inflation targeting remains the best contribution that monetary policy can make to promoting economic and financial stability.

Work should also be done to improve the identification of asset-price misalignments ex ante in order to help identify the sources of misalignments, in particular, the contribution of monetary policy to fuelling the misalignment. We find the evidence compelling that a buildup in credit can contribute to the formation of asset-price misalignments as suggested by Borio and White (2004). Ultimately, housing and equity prices should be part of the models that the Bank regularly uses for policy analysis.

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