March 2005
IMF Country Report No. 05/81

United Kingdom: Selected Issues

The Selected Issues paper for the United Kingdom was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on February 14, 2005. The views expressed in this document are those of the staff team and do not necessarily reflect the views of the government of the United Kingdom or the Executive Board of the IMF.

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International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

UNITED KINGDOM

Selected Issues

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Approved by the European Department

February 14, 2005

Contents Page

Tables

Figures

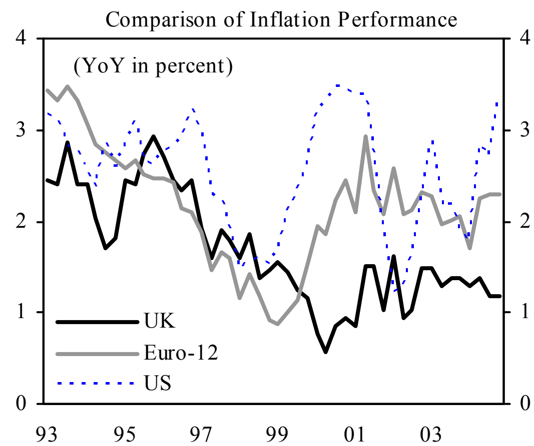
Boxes

Appendices

I. Why Has Inflation Been Low?[1]

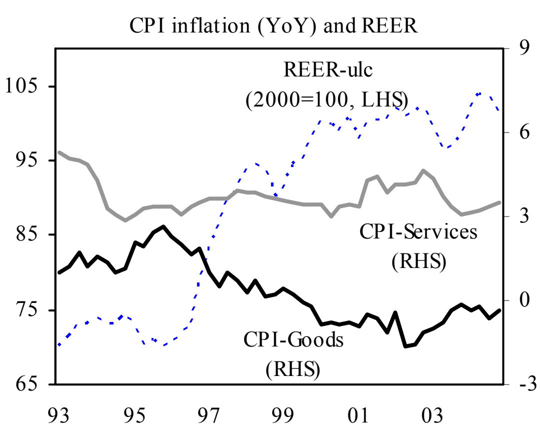
A. Overview and Introduction

1. **Despite higher oil prices and limited slack in the economy, the U.K. CPI inflation has remained surprisingly low in recent years.** Inflation fell to below 2 percent during 1993–99, similarly to developments in the United States and the euro area. Since 1999, while inflation edged up in both the United States and the euro area, it has remained low and stable in the United Kingdom, averaging about 1¼ percent. This impressive inflation performance did not appear to come at the expense of lower growth, with the U.K. economy weathering the global slowdown better than both the United States and the euro area. In fact, U.K. growth has remained not only robust but unemployment has also declined from about 6 percent in 1999 to 4¾ percent in 2004.



2. **It is widely recognized that the adoption of inflation targeting in 1992 and the subsequent decision to give the Bank of England operational independence have been key factors contributing to the U.K.'s stable and low inflation environment** (Box I.1). Since 1997 when the target for inflation was changed to a point target, long-term inflation expectations (10-year-ahead), measured by the difference in the yields on indexed and non-indexed government bonds, have been firmly anchored to the target. Between 1997 and 2003, RPIX inflation remained on average close to the target. However, over the past year CPI inflation has remained below the 2 percent target, undershooting prior projections. Why has inflation been so low? In part, it may be due to a series of favorable external shocks.

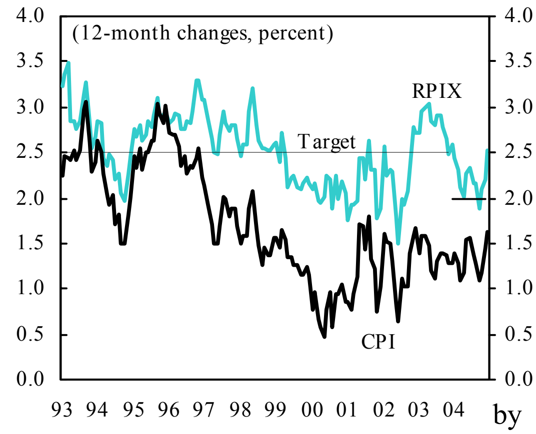
3. **These favorable external shocks have been reflected in the striking differences between goods inflation and services inflation.** Prices for services, which now account for about half of the U.K. CPI basket, have been relatively stable since 1995, increasing at an average annual rate of about 3½ percent. In contrast, goods prices have declined since 1999, falling at an average annual rate of ¾ percentage points, offsetting inflationary pressures from services.



[1] Prepared by Keiko Honjo.

Box I.1. Inflation Measures and Targets in the United Kingdom[1]

Inflation Performance

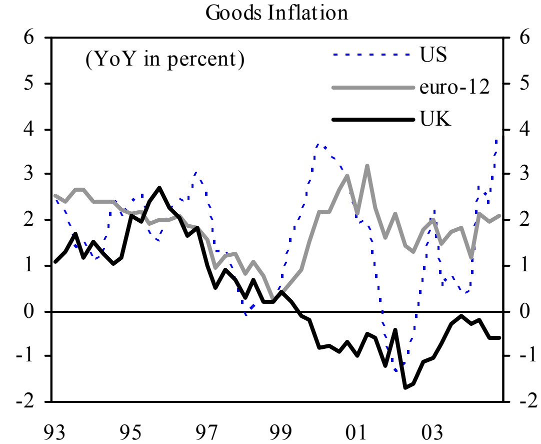


The United Kingdom adopted inflation targeting in October 1992 in the aftermath of its exit from the ERM of the European Monetary System. Originally, the target was set in terms of the traditional Retail Price Index (RPI) excluding mortgage interest payments—referred to as RPIX.[2] RPIX inflation was to be maintained in the lower half of the range of 1–4 percent. The present inflation targeting framework was introduced in 1997, when responsibility for making interest rate decisions was transferred to the Monetary Policy Committee (MPC) of the Bank of England. The target was redefined as a point target of 2½ percent as measured by RPIX.

In December 2003, with a view to facilitating convergence with the euro area, the Chancellor changed the MPC's remit to targeting 2 percent inflation as measured by the harmonized index of consumer prices, called the CPI in the United Kingdom. Given the differences in composition, coverage, and aggregation between the RPIX and the CPI, the new 2 percent target for CPI inflation is roughly consistent with RPIX inflation of 2¾ percent; similarly the previous 2½ percent target for RPIX inflation was consistent with CPI inflation of 1¾ percent.

1/ For more details about the experience of the United Kingdom with inflation targeting, see for example Bean (2003).
2/ RPI includes various costs associated with owner-occupied housing costs including council tax, mortgage interest payments and housing depreciation.

Goods Inflation



4. **The decline in goods prices is largely attributable to competitive pressures.** Increased globalization of production following the conclusion of the Uruguay Round and strong productivity growth in the IT industry were contributing factors. The emergence of China as a major exporter of textiles and other small manufactured goods also increased competition in world markets, and other Asian countries became significantly more price competitive after their currencies depreciated during the 1997–98 Asian crisis. Since 1995, U.K. imports of goods from the

emerging Asian economies[2] have increased from about 8 percent (1 percent from China) to nearly 12 percent (4¼ percent from China) of total imports. In addition, the United Kingdom experienced a more than 30 percent real appreciation of sterling in 1996–97, which served over time to limit increases in domestically produced goods prices. Both the United States and the euro area have also benefited from declining goods inflation in the 1990s, as a similar tendency for rising imports, especially from Asia, reflected increased competitive pressures. However, in contrast to the United Kingdom, the tendency for goods inflation to decline has dissipated in recent years in these economies.

5. **This paper attempts to shed light on the dynamics of the inflation process, particularly the influence of external shocks, to help understand the recent low inflation environment in the United Kingdom.** It is organized as follows. Section B provides a brief summary of existing empirical work. Section C presents the expectations-augmented Phillips curve model used in the analysis. Section D presents the results, followed by concluding remarks in Section E. The basic conclusion is that low inflation in recent years can be explained reasonably well by a combination of increased competitive pressures, as proxied by sterling real appreciation, declining import prices, and an important degree of persistence in inflation. Looking ahead, the model suggests that, based on the assumptions and forecasts in the most recent World Economic Outlook, inflation in the United Kingdom will rise gradually towards the 2 percent target over the next 2–3 years. Three factors will contribute to push inflation higher: rising import prices; the closing of the small output gap in the United Kingdom; and well-anchored inflation expectations.

B. Summary of Existing Empirical Work

6. **Expectations-augmented Phillips curves have been widely used in analyzing price adjustments to changes in some measure of real disequilibrium in goods or labor markets.** A common specification of the traditional Phillips curve takes the following form:

$$(1) \qquad \pi_t = \alpha\pi_t^e + \beta gap_t + \varepsilon_t \qquad \varepsilon_t \sim N(0,\sigma_\varepsilon^2)$$

where π_t is inflation, π_t^e is inflation expectations, *gap* is excess demand measured as the difference between actual and potential output—the output gap, and ε is a disturbance term. β measures the impact of the output gap on inflation; inflation rises proportional to the extent of a positive output gap in the economy.

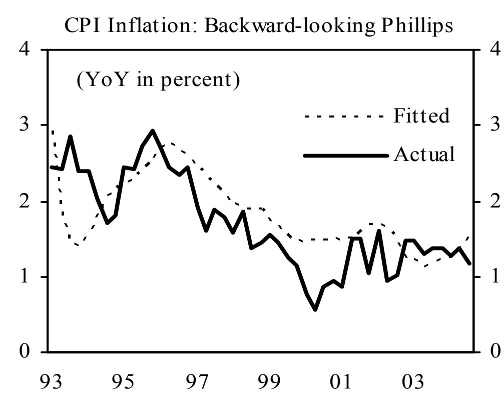
[2] Including China, Hong Kong SAR, Malaysia, Philippines, South Korea, Singapore, Taiwan, and Thailand.

7. Based on the specification for inflation expectations suggested by Rudebusch-Svensson (1999), the following equation was estimated over the period 1981:Q1 to 2004:Q3 using four lags of inflation as a proxy for adaptive or backward-looking expectations (standard errors are shown in parenthesis):[3]

$$(2) \qquad \pi_t = \underset{(0.098)}{0.15}\,\pi_{t-1} + \underset{(0.096)}{0.28}\,\pi_{t-2} + \underset{(0.093)}{0.24}\,\pi_{t-3} + \underset{(0.093)}{0.25}\,\pi_{t-4} + \underset{(0.160)}{0.58}\,gap_t + \varepsilon_t\,,$$

where π_t is seasonally adjusted quarterly CPI inflation at an annual rate and gap_t is excess demand—calculated based on detrended output using a Hodrick-Prescott (HP) filter. The coefficients on lagged inflation sum up close to unity, which suggests considerable persistence in inflation.[4] The output gap term enters significantly with a positive sign.

8. **This simple backward-looking Phillips curve model does a reasonably good job in fitting the historical data.** However, it persistently overpredicts inflation during the period 1997–2002, following the sharp appreciation of sterling. The overprediction also reflects the limitation of backward-looking expectations, as agents' expectations adjust only slowly to declining inflation.



9. **To better characterize the inflation dynamics in the United Kingdom, a recent strand of the literature has adopted broadly four different approaches:** (i) the introduction of external shocks in a variety of Phillips curve models (e.g., Kara and Nelson (2002)); (ii) the New Keynesian Phillips Curve derived from micro-foundations with an explicit forward-looking component in inflation expectations formation (e.g., Balakrishnan and López-Salido (2002)); (iii) a Kalman filter, which jointly estimates the Phillips curve and a time-varying NAIRU to capture the dynamics underlying structural changes in the United Kingdom (e.g., Greenslade et al. (2003) and Driver et. al. (2003)); and (iv) an analysis

[3] See the Appendix for an explanation of the data set used.

[4] An alternative estimate of inflation persistence (or inertia), derived from an estimated autoregressive model of inflation, suggests a gradual decline in persistence over time; however, it remains considerable.

focusing on credibility and inflation expectations in inflation targeting regime (e.g., Laxton and N'Diaye (2002)). These approaches have pointed to the importance of external shocks and inflation expectations in explaining the dynamics of U.K. inflation. However, as shown by Balakrishnan and López-Salido (2002), there is little empirical evidence to support the proposition that forward-looking expectations play a dominant role in inflation dynamics in the United Kingdom. Similarly, Batini and Nelson (2002) show that there is a considerable sluggishness in the response of inflation to changes in monetary policy in the United Kingdom, and that this response lag has persisted over different monetary policy regimes.

10. **This paper uses a model based on an expectations-augmented Phillips curve, taking into account the influence of external shocks in the context of inflation targeting.** Despite wide use, the traditional Phillips curve model has been criticized for being subject to the Lucas (1976) critique, which suggests that the underlying structural relationships contributing to the inflationary process cannot be identified with a reduced-form specification, as the parameters are unlikely to be stable over different monetary policy regimes. Notwithstanding their limitations, the focus of Phillips curve models on the relationship between inflation and the output gap makes them useful for policy simulation exercises.[5] This paper aims to contribute to the understanding of U.K. inflation dynamics by including a measure of external shocks to take account of the long-term effects of competitiveness changes. It also uses a hybrid formulation for inflation expectations, which allows for both forward-looking and lagged inflation following Chadha, Masson, and Meredith (1992) and Laxton and N'Diaye (2002).

C. Model Specification

11. **With exports and imports accounting for roughly a third of GDP, the United Kingdom is a highly open economy, which suggests that the economy is sensitive to external shocks.** Inflation in an open economy, relative to a closed economy, is affected by an additional transmission channel arising from changes in competitiveness and other import price shocks. To capture both current and lagged effects of external shocks, the model includes contemporaneous and lagged changes in import prices, and the effect of increased competitiveness pressures, proxied by changes in the real exchange rate based on unit labor costs. The competitiveness pressures are specified as a moving average process to summarize long-term effects.[6] The augmented model of the Phillips curve is given by:

[5] Ericsson and Irons (1994) show that the lack of significant empirical evidence supporting the Lucas critique indicates that it may still be valid to use reduced-from models for empirical estimation.

[6] Most other studies looking at the long-term effects of competitiveness use the real exchange rate with a four-quarter lag.

(3) $$\pi_t = \pi_t^e + \sum_{j=1}^{4} \delta_j \Delta Pm_{t-j} + \mu \Delta_4 REER(L)_t + \lambda gap_{t-j} + \theta \Delta gap_{t-j} + \varepsilon_t \ ,$$

(4) $$\pi_t^e = \alpha \pi_t^f + \sum_{j=1}^{4} \beta_j \pi_{t-j} \ ,$$

(5) $$\pi_t^f = \phi \pi^* + (1-\phi)\pi 4_{t-1} \qquad 0 \le \phi \le 1 \text{, and}$$

(6) $$\alpha + \sum_{j=1}^{4} \beta_j + \sum_{j=1}^{4} \delta_j + \mu = 1 .$$

In this specification, inflation depends on inflation expectations (π_t^e), contemporaneous and lagged changes in import prices (*Pm)*, a moving average of changes in the real exchange rate (*REER),* the level of the output gap gap_{t-j}, and the change in the gap (Δgap).[7] In addition to the impact of the level of the output gap on inflation, the rate of closure of the gap matters, as the model also incorporates "speed limit effects" by including the change in the gap. The output gap is calculated using a production function approach to attempt to capture more structural elements than the simple HP filter. The sum of the coefficients excluding those on the output gap is restricted to be equal to one. This restriction ensures that there is no trade-off between inflation and output in the long-run equilibrium.

12. **Inflation expectations consist of a forward-looking and a backward-looking component.** The *forward-looking* component is based on the monetary authorities' inflation objective (π^*). Consistent with the timing of the adoption of inflation targeting in the United Kingdom, this study assumes $\pi^*=1.7$ from 1993 until the change in end-2003, and $\pi^*=2$ in the subsequent period. The *backward-looking* component reflects the degree of persistence in inflation. It reflects people's expectations as to how fast the monetary authorities will adjust the policy rate of interest to steer inflation toward the target. More specifically, it reflects people's view about the frictions in price adjustment, such as the presence of uncertainty about competitors' price decision, and lags between cost changes and price adjustments (Blinder, Canetti, Lebow and Rudd (1988)). It may also reflect that some fraction of firms may use a strategy of backward-looking rule-of thumb pricing. Following the specification

[7] The operator Δ denotes a one-quarter change and Δ_4 four quarter changes. All quarterly changes are on annual basis.

suggested by Laxton and N'Diaye (2002), inflation expectations are defined as a linear combination of the target and observed lagged inflation.[8]

D. Results

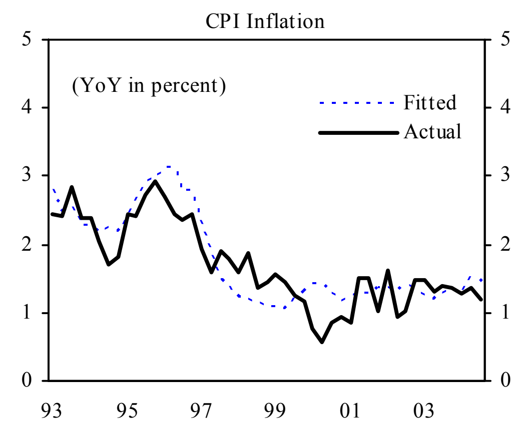
13. Using a general to specific modeling strategy, the following equation for the alternative model of inflation was estimated over the period 1981:Q4 to 2004:Q3:

$$\text{(7)} \quad \underset{}{\pi_t} = \underset{(0.088)}{0.39\pi_t^f} + \underset{(0.094)}{0.12\pi_{t-1}} + \underset{(0.079)}{0.24\pi_{t-2}} + \underset{(0.081)}{0.16\pi_{t-3}} + \underset{(0.076)}{0.09\pi_{t-4}} + \underset{(0.016)}{0.06\Delta Pm_t} + \underset{(0.017)}{0.03\Delta Pm_{t-2}}$$

$$\underset{(0.036)}{-0.098\Delta REER_t} + \underset{(0.12)}{0.54gap_{t-4}} + \underset{(0.15)}{0.48(gap_t - gap_{t-3})} + \underset{(1.36)}{7.5d91Q2} + \varepsilon_t$$

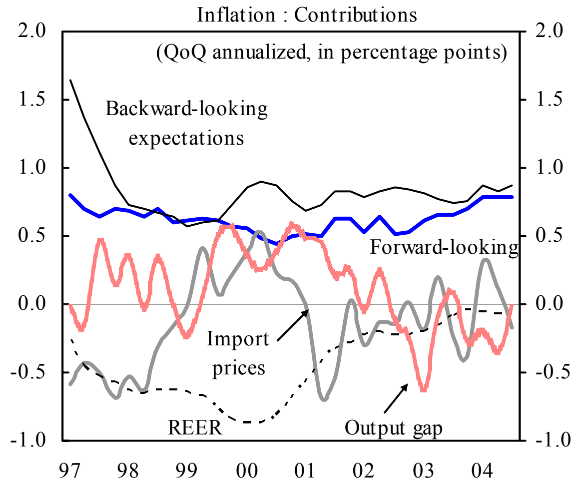
Adjusted $R^2 = 0.75$

Virtually all estimated coefficients have the anticipated signs. Both effects of the output gap enter significantly with positive signs. The level of the output gap a year ago affects inflation but also the speed at which the gap is closed during the succeeding three quarters. In estimating this equation, a 16-quarter moving average of the real exchange rate was chosen as best fitting the historical data, as well as minimizing the forecast errors in and out of sample. *d91Q2* is a dummy variable for the second quarter of 1991. A test for the imposed restriction on the sum of coefficients cannot be rejected, consistent with a vertical long-run Phillips curve.



14. **The equation based on the alternative inflation model fits the data better than the simple model, especially during the period after 1996**. The equation suggests that the low inflation environment in the United Kingdom during this period can be explained reasonably well by downward pressures from external shocks coupled with an important degree of persistence in inflation (see chart below). The favorable impact on inflation of increases in

[8] The coefficient ϕ is related to the average time required by the monetary authorities to eliminate any deviation between observed inflation and the inflation target. In general, it takes the monetary authorities around six to eight quarters to achieve the inflation objective after a shock. This study assumes ϕ=0.5, which is consistent with the range suggested by Laxton and N'Diaye (2002) and Batini and Nelson (2002).



competitive pressures, as proxied by the sharp real appreciation of sterling in 1996–97, peaked in 2000. In particular, it helped to sustain downward pressures on inflation by offsetting pressures from a rebound in import prices during 1999 and 2000. Since then, import prices have declined, playing an increasing role in holding inflation down. The backward-looking component of inflation expectations, in turn, has spread the favorable effects on inflation of the external shocks over time.[9]

15. **The importance of inflation persistence does not conflict with the presence of credible inflation targeting and expectations anchored close to the target.** Lags in monetary transmission support a degree of stability in inflation on one hand, while credible inflation targeting would ensure that inflation converges toward the target. In addition, as inflation settles down near the target, it becomes increasingly difficult to identify whether the backward- or the forward-looking component of expectations is playing a relatively more important role in explaining inflation.

16. **Forecasting with the estimated inflation equation suggests that U.K. inflation will rise gradually towards the 2 percent target over the next 2–3 years** (see charts below). The upper and lower bounds in the chart represent the projected mean squared error of the forecast. Under the staff's baseline projections, the small negative output gap in the U.K. economy is expected to be eliminated in 2005, and there would be no output gap over the medium term as output would grow at potential. At the same time, import prices are projected to rise—based on the assumptions and projections in the most recent World Economic Outlook (WEO).[10] These two factors and well-anchored forward-looking expectations would all work to drive inflation to target. But the persistence in inflation would work to slow the convergence. Accordingly, the equation predicts that CPI inflation will rise to 1¾ percent by end-2006 and reach 2 percent in three years time. However, these

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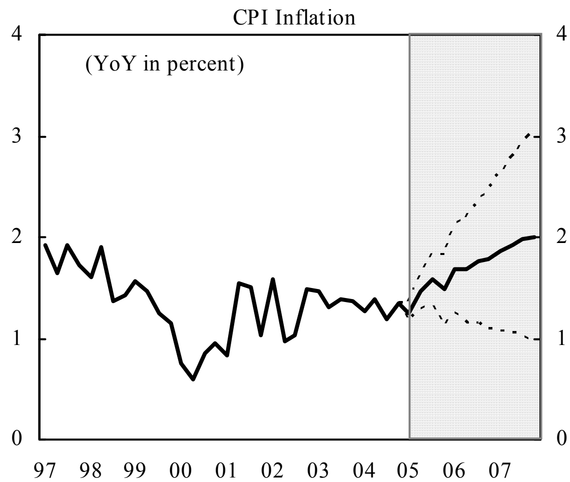
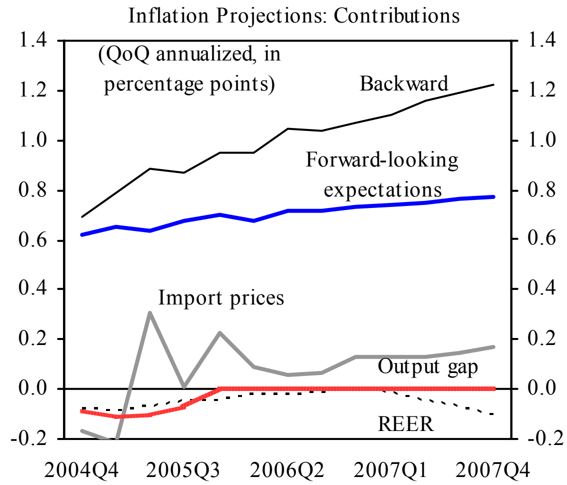
[9] Standard tests for a structural break in the CPI equation suggest that such a break might exist in the early 1990s, which would be consistent with a prior expectation of a change in inflation expectations with a shift from a deflationary to a stable inflation environment. A CPI equation estimated over the period from 1992 to 2004 indicates that the explanatory power of the forward-looking component of inflation expectations increases significantly, particularly in gearing inflation towards the target; inflation persistence, however, continues to play an important role in slowing the rise in inflation.

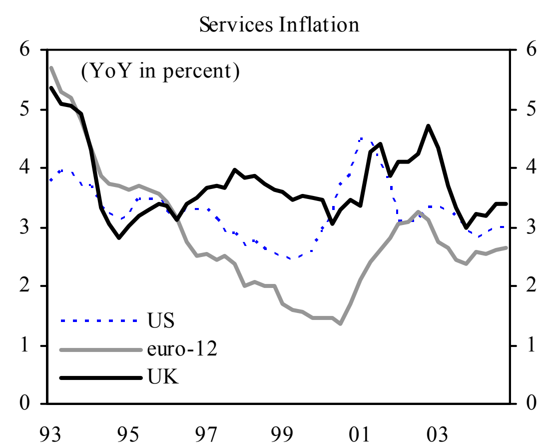
[10] The WEO projects 12-month change import prices to rise gradually from just above zero in 2004Q3 to about 2 percent by the end of 2007.





projections need to be interpreted with some caution as forecast errors are generally large as shown in the chart, and this is only a partial-equilibrium model.

17. **There are some significant uncertainties associated with the projection.** An important downside risk stems from estimates of the current output gap. If there is actually more slack in the economy at present, as estimated by the U.K. Treasury, for example, then inflation would pick up more slowly than forecast.[11] There are also uncertainties regarding the projection of rising import prices going forward. In particular, with competition in world clothing and textile markets expected to stiffen with the phase out of MFA quotas at the end of 2004 and continuing strong competition provided by Asian economies, it is not clear whether import prices will rise as quickly as projected. Indeed, over the past several years, the WEO has consistently projected a pick-up in import prices 2-3 years ahead, and the actual data have continued to surprise on the downside. Important upside risks center on the pace of increase in the prices of oil and other raw materials, and how much of such price increases is likely to be passed on to consumer prices. Finally, relatively high services inflation in the United Kingdom poses another uncertainty in the forecast. One would expect that sustained competitive pressures on



[11] While there are large uncertainties associated with estimates of the output gap, the widely accepted view in the United Kingdom is that the economy is operating in the neighborhood of full capacity.

the tradable sector would contribute in part to contain pressures on the non-tradable sector. However, it is not clear how this will play out.

E. Conclusions

18. **The analysis presented in this paper suggests that the recent low inflation in the United Kingdom can be explained reasonably well by a combination of downward pressure from external shocks and persistence in inflation.** Specifically, the favorable impact of increased competitive pressures, as proxied by sterling real appreciation and declining import prices has helped to contain inflationary pressures. Persistence in inflation, in turn, has spread the favorable effects on inflation of the external shocks over time. A forecast based on the assumptions in the most recent WEO suggests that inflation in the United Kingdom will rise gradually towards the 2 percent target over the next 2–3 years.

19. **Looking ahead, the model suggests that key uncertainties for monetary policy will be associated with prospects for import prices and the size of the output gap.** In particular, difficulties in forecasting import prices, which are affected by a wide range of forces outside of the U.K. monetary authority's control, could pose a significant policy challenge. If import prices do not pick up as projected and goods prices remain subdued reflecting competitive pressures, a question arises as to whether the Bank of England should attempt to achieve higher services inflation to steer overall inflation up to 2 percent. The decision may entail the risk of having to bring down services inflation in the future when import prices do come back, which could be costly in terms of foregone output. Alternatively, should the Bank just take a wait-and-see approach until import prices eventually come back? However, such an approach also might entail costs, as it is not clear how long inflation can remain below the target without jeopardizing monetary policy credibility.

Data Sources and Definitions

This appendix describes data sources and definitions used in the model of inflation in the United Kingdom for 1981:Q1-2004:Q3.

Inflation (π): Quarterly inflation on annual basis, calculated from CPI index, seasonally adjusted. Data prior to 1988 have been extrapolated using the historical estimates published in the Office for National Statistics (ONS) *Economic Trends* No. 541 (December 1998).
Data source: ONS.

Output gap ($gap_t = y_t - y_t^*$): Based on staff's estimates using the standard production function approach. The potential output is computed as the product of TFP, capital, and labor factors at their notional "potential" levels under a Cobb-Douglas technology assumption. Potential capital is defined as actual non-residential fixed capital plus inventories. Potential TFP is calculated by filtering the actual TFP component with a HP filter. Labor input is measured by hours. The staff's potential growth projection is 2.6 percent.
Data source: ONS.

Import prices (Pm): Quarterly changes on annual basis calculated from import price index for total trade in goods; not seasonally adjusted as there are no statistically significant seasonal factors using a standard X12 technique.
Source: ONS.

Real exchange rate (REER): Based on unit labor costs. The moving average process is calculated using year-on-year changes over the lag period.
Source: IFS.

Inflation target (π*): 1.7 percent from 1993 to 2003, following the adoption of inflation targeting in 1992, and 2 percent in 2004.

References

Balakrishnan R., and J.D. López-Salido (2002), "Understanding U.K. Inflation: the Role of Openness," Bank of England Working Paper No. 164.

Bank of England (1999), "Economic Models at the Bank of England."

Batini, N. and E. Nelson (2002), "The Lag from Monetary Policy Actions to Inflation: Friedman Revised," External MPC Unit Discussion Paper No. 6.

Bean, C. (2003), "Inflation Targeting: The U.K. Experience," Bank of England, October 2003.

Benati, L. and G. Kapetanios, "Structural Breaks in Inflation Dynamics," December 2002.

Campa, J. M., and L. S. Goldberg (2002), "Exchange Rate Pass-through into Import Prices: A Macro or Micro Phenomenon?" National Bureau of Economic Research Working Paper 8934.

Chadha, B., P. R. Masson and G. Meredith (1992), "Models of Inflation and the Costs of Disinflation," IMF Staff Paper Vol. 39, No. 2.

Debelle, G., and J. Wilkinson (2002), "Inflation Targeting and the Inflation Process: Some Lessons from an Open Economy," Reserve Bank of Australia Research Discussion Paper 2002-01.

Driver, R. L., J. V. Greenslade, and R. G. Pierse (2003), "The Role of Expectations in Estimates of the NAIRU in the United States and the United Kingdom," Bank of England Working Paper No. 180.

Ericsson, N., and J. S. Irons (1994), "The Lucas Critique in Practice: Theory Without Empirical Basis," *Macroeconometrics: Development, Tensions, and Prospects*, Ed. By Kevin D. Hoover.

Fuhler, J.C. (1997), "The (Un)Importance of Forward-Looking Behavior in Price Specifications," *The Journal of Money Credit and Banking*, Vol. 29, pp. 338-50.

Herzberg, V., G. Kapetanios, and S. Price. (2003), "Import Prices and Exchange Rate Pass-through: theory and Evidence from the United Kingdom," Bank of England Working Paper No. 182.

Kara, A. and E. Nelson (2002), "The Exchange Rate and Inflation in the U.K.," External MPC Unit Discussion Paper No. 11.

King, M., (2002), "The Inflation Targeting 10 Years On," Speech delivered at London School of Economics on November 19, 2002.

King, M., (2005), Speech delivered at the CBI on January 20, 2005.

Laxton, D., and P. N'Diaye (2002), "Monetary Policy Credibility and the Unemployment-Inflation Trade-Off: Some Evidence from 17 Industrial Countries," IMF Working Paper, WP/02/220.

Lucas, R., (1976), "Econometric Policy Evaluation: A Critique," *Carnegie-Rochester Conference Series* on Public Policy, Vol. 1, pp. 19-46.

Rotemberg, J., and M. Woodford, (1999), "The Cyclical Behavior of Prices and Costs," *Handbook of Macroeconomics* (ed. Taylor, J.B., and M. Woodford) Vol. 1, pp. 1,050-1,135.

Rudebusch, G.D., and L. Svensson, (1999), "Policy Rules for Inflation Targeting," *Monetary Policy Rules*, University of Chicago Press, pp. 203-246.

Svensson, L., (2000), "Open-Economy Inflation Targeting," *Journal of International Economics*, Vol. 50(1), pp. 155-183.

II. How Should Policymakers Respond to a Decline in House Prices?[1]

A. Introduction

1. **For a sustained period, house prices in the United Kingdom have been appreciating sharply, and given the high correlation between house price and real activity, a possible retrenchment could have important macroeconomic implications.** In this paper, MULTIMOD, one of the IMF's multi-country macroeconomic models is used to examine the implications of a possible retrenchment in real house prices in the United Kingdom. The focus of the analysis is on how policy might best respond to a sharp fall in house prices, in particular the relative roles of monetary and fiscal policy. A key dimension of this policy-mix question is how the fiscal response might complicate meeting the fiscal rules.

2. **Several factors account for the high correlation between house prices and the real economy.** First, strong preferences for home ownership result in a high income elasticity of housing demand. Further, the predominance of variable-rate mortgages implies that housing demand is also highly interest rate sensitive. While these factors lead to large cyclical fluctuation in housing demand, the price elasticity of housing supply is quite low resulting in demand fluctuations being quickly transmitted into prices. Additionally, financial accelerator effects operating through the impact of house prices on household balance sheets contribute further to overall variability in consumption demand. The confluence of these factors means that there is a high degree of simultaneity in the cyclical correlation of house prices and the macro economy that policymakers need to be cognizant of as they strive to achieve their objectives.

3. **The analysis focuses on four key questions.** First, given the sustained period of rapid house price appreciation, what do various estimates of the sustainable level for house prices suggest about the possible degree of current overvaluation? Second, given the historically high correlation between real house prices and real activity, how large an impact on the real economy could a decline in house prices have? Third, how can policy be conducted to mitigate the macroeconomic disruption arising from a possible decline in house prices? Fourth, if house price declines do materialize, what policy mix would best safeguard the credibility of the monetary and fiscal policy frameworks?

4. **Although there is uncertainty about the extent of possible overvaluation in the housing market, how it may be resolved, and the resulting broad macroeconomic implications, risk analysis is central to good macro policy management.** The analysis presented in this paper should be interpreted in exactly that context, analysis of a possibly

[1] Prepared by Ben Hunt with help from Marialuz Moreno Badia in updating the estimated U.K. house price equation initially presented in IMF (2003). The author also acknowledges the assistance of Jared Bebee in preparing the charts.

significant risk to continued strong and stable macroeconomic growth in the United Kingdom. As such, the analysis is tilted toward examining the worst possible outcomes to gauge the economy's resilience and consider policy options that can mitigate the potential negative consequences.

5. **The remainder of the paper is structured as follows.** Section B presents some estimates of the degree of possible overvaluation in house prices and outlines the links between house prices and the macro economy. In Section C, a brief overview of MULTIMOD is presented focusing primarily on the transmission channels of the shocks considered and the characterizations of monetary and fiscal policy. The simulation results are presented in Section D. Section E concludes.

B. House Prices and The Macro Economy

Current house prices and sustainable levels

6. **A range of indicators suggest that current house prices in the United Kingdom may be above the sustainable level.** The ratio of house prices to rents, the ratio of house prices to average household disposable income, real house prices relative to linear time trends and an econometric real house price equation estimated in IMF (2003), all suggest that house prices are currently above what can be thought of as a sustainable or equilibrium value.

7. **The current ratios of house prices to rent and to average household disposable income are at or close to their historical peaks.** Within an asset-pricing context, the ratio of house prices to rents can be thought of as a price-earnings ratio, with rents reflecting prospective income.[2] Looking at the evolution of this ratio graphed in the right panel of Figure II.1 indicates that the current level is close to the historical peaked reached in early 1989. Experience suggests that this ratio will likely move back toward its long-run average of 19. The evolution of the ratio of house prices to average household disposable income in the left panel of Figure II.2 presents a similar story. In spite of strong growth in disposable income, the recent rapid pace of house price appreciation has resulted in a current level of the ratio that is about 25 percent above its historical average.

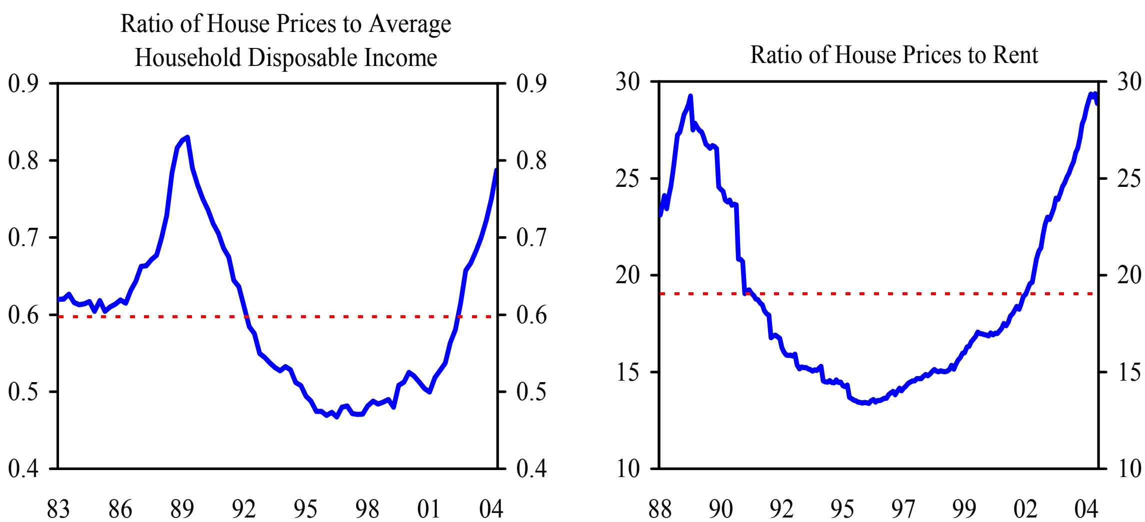
[2] Using a framework similar to the dividend-discount model used for equity valuation implies the following:

$$P_t = \frac{E_t}{(1+R)} + \frac{E_{t+1}}{(1+R)^2} + ... = \sum_{j=1}^{\infty} \frac{E_{t+j-1}}{(1+R)^j},$$

where P is the house price, E is the rent and R is the discount rate.
Assuming that rents grow at a constant rate, g, r^f is the risk-free rate, and δ is the housing risk premium then the housing price-earnings ratio can be derived from the above as:

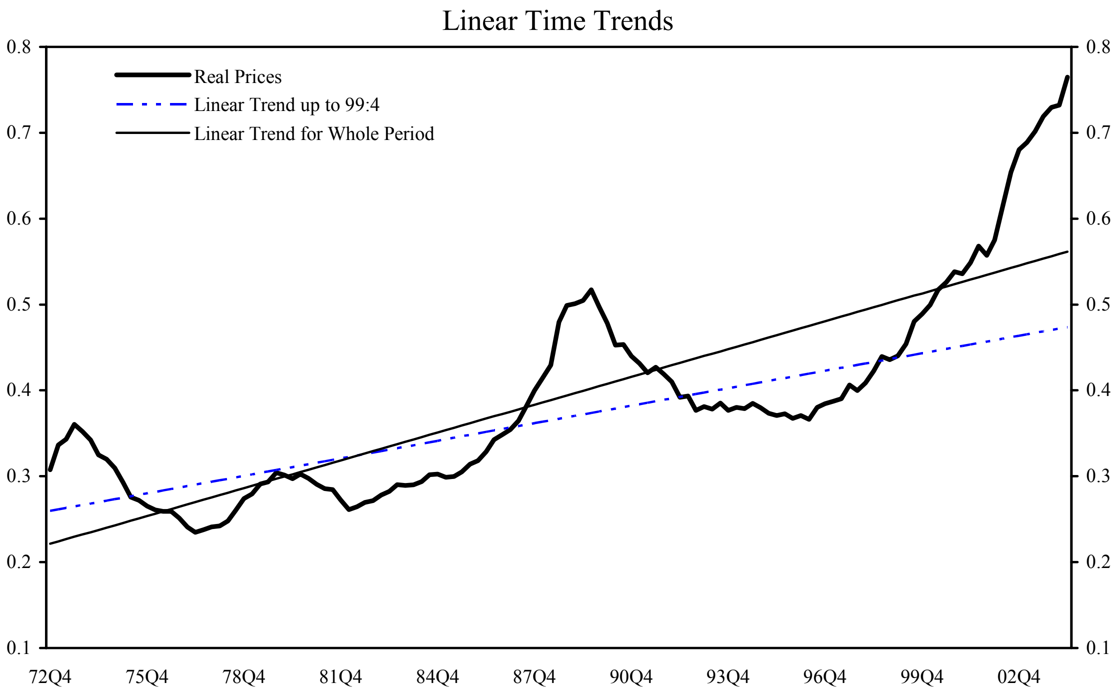
$$\frac{P_t}{E_t} = \frac{1}{(R-g)} = \frac{1}{(r^f + \delta - g)}.$$

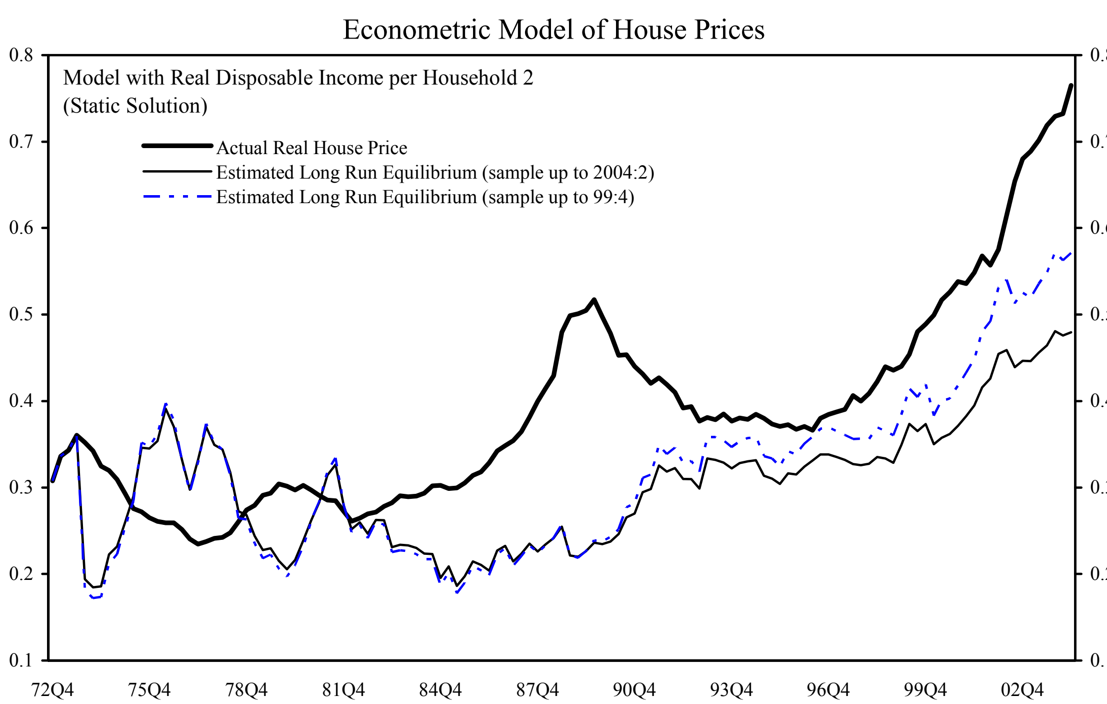
Figure II.1. The Ratios of House Prices to Rents and Average Household Disposable Income



8. **Simple linear time trends and an econometric model of real house prices suggest a range of overvaluation that depends on the time period used for estimation.** Estimating a simple linear time trend up to 1999Q4 suggest overvaluation of roughly 65 percent in 2004Q2 (top panel in Figure II.2). However, extending the estimation period to 2004Q2 suggests more modest overvaluation of about 35 percent. This difference is not surprising as extending the sample period allows more of the recent run-up in house prices to be interpreted as trend. The econometric error-correction model, presented in IMF (2003) and updated in Appendix 1, models real house prices as a function of real disposable income and the real inter-bank interest rate. Interpreting the cointegrating relationship as providing an estimate of equilibrium house prices suggests that the extent of overvaluation ranges from 34 percent, if the equation is estimated up to 1999Q4, to 60 percent, if the equation is estimated up to 2004Q2 (bottom panel of Figure II.2). This difference arises largely because the coefficient on disposable income in the cointegrating vector, which is quite high in the United Kingdom relative to other industrial countries, declines from close to 2 to 1.5 when the equation is estimated over the longer sample period. Although no intuitive reason for the decline in the estimated coefficient is readily apparent, the change highlights the fact that all of these estimates should be interpreted cautiously, with the focus being on the broad picture coming from the range of techniques rather than any single estimate alone.

Figure II.2. House Prices and Estimated Equilibrium Levels





9. **Plausible arguments can be made that the sustainable level for house prices may be higher than these indicators suggests.** With the establishment of credible monetary and fiscal policy frameworks, both nominal and real interest rates in the United Kingdom are likely permanently lower than many would have expected in the 1980s or early 1990s. Permanently lower nominal and real interest rates could have raised the sustainable ratios of house prices to rents and disposable income more than the historical average would suggest.[3] The impact of such structural change may also not be fully captured in the linear time-series estimates of equilibrium or trend real house prices either. In addition, demographic factors have also been cited as adding to housing demand thereby increasing sustainable price levels. Consequently, one should be careful about drawing precise conclusions about the extent of overvaluation suggested by these indicators.

10. **Although reasonable people could conclude that the range of possible overvaluation in the housing market is quite wide, cautious policymakers should be thinking about the implications of a possible retrenchment, including a large one.** Considering the various estimates of overvaluation along with the arguments as to why these estimation techniques may not be fully capturing structural effects from significant improvements in monetary and fiscal frameworks, the overvaluation in the housing market could lie within the 0 to 60 percent range. With so many indicators pointing toward some overvaluation along with the historical tendency of some markets to over shoot, the possibility of some correction in real house prices cannot be completely discounted. Policymakers need to remain cognizant of the risk of a correction and its macroeconomic implications.

House prices and real activity

11. **There is a high degree of correlation between real house prices and real economic activity in the United Kingdom.** As indicated by the deviation of house prices from a linear time trend and the output gap graphed in Figure II.3, house price cycles have tended to follow the business cycle quite closely in the United Kingdom. Periods of excess demand tend to be associated with house prices rising above trend. The relationship between house prices and consumption, as studied in detail in HM Treasury (2003b), underlies the high correlation.[4] Factors such as strong preferences for the consumption of housing services, inelastic supply, variable-rate mortgages and a strong financial accelerator channel linked to house prices are cited as the key reasons for the high correlation between real activity and house prices. What is somewhat surprising with the current cycle is that house prices have not yet started to move back toward trend even though real activity is now approaching trend from below.

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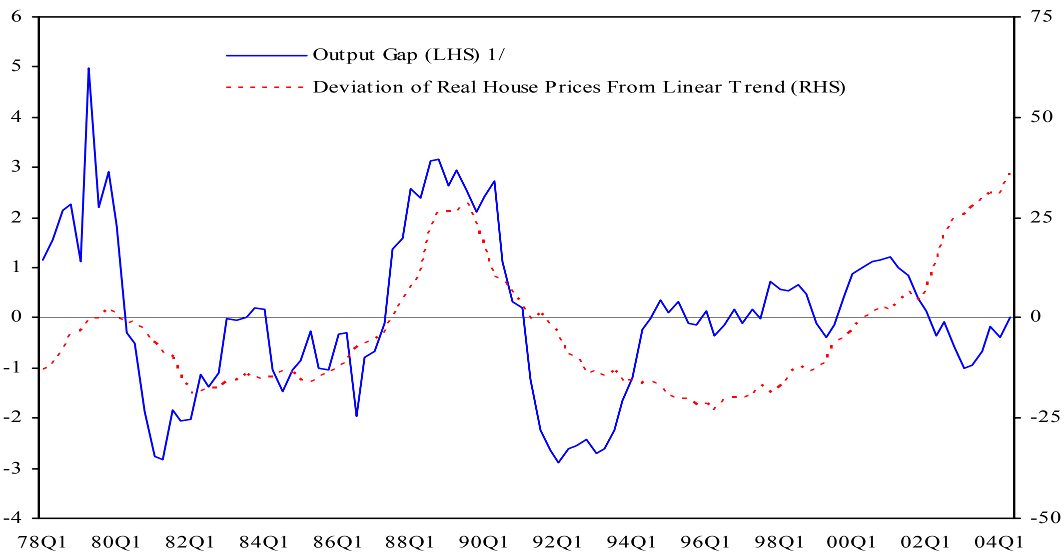
[3] See Nickell (2004) and Barker (2005).

[4] HM Treasury (2003b) is one of the studies accompanying the assessment of the five economic tests analyzing the decision on EMU membership in HM Treasury (2003a).

Figure II.3. The Output Gap and the Deviation of House Prices from Trend



1/ Source: Staff estimates.

12. **In an international context, the income elasticity of house prices in the United Kingdom tends to be quite high.** The estimated U.K. income elasticity of house prices is well above unity as indicated by the house price equation estimates presented in Appendix 1 and those in mentioned in Chapter IV of this paper. The pooled income elasticity of house prices for a range of industrial countries presented in Otrok and Terrones (2005) is considerably lower than this at roughly ½. Strong preferences for housing coupled with relatively low price elasticity of supply (see Barker (2004)) are the factors that result in this high income elasticity of house prices.

13. **Housing and consumption demand in the United Kingdom are sensitive to movements in short-tem interest rate because of the predominance of variable-rate mortgages.** The structure of mortgage finance influences housing demand because of its direct effect on affordability. When short-term interest rates are low because monetary policy is attempting to support economic recovery, housing affordability is high and aggregate demand and housing demand rise together. Further, because of the large stock of mortgage debt financed largely with variable-rate mortgages, fluctuations in short-term interest rates have an enormous impact on homeowners' debt-service costs and, consequently, the amount of disposable income available to finance consumption expenditures. When interest rates are low, debt-service costs fall and a larger portion of household disposable income is available to finance consumption expenditure.[5]

[5] Miles (2004) contains an in-depth study of the U.K. mortgage market and outlines the policy options for encouraging households to move more toward fixed-rate mortgages.

14. **Rising house prices themselves also stimulate consumption because innovations in the U.K. financial markets over the 1980s have made it easier for households to access the equity in their homes to finance current consumption.** This financial accelerator channel and its implications for monetary policy in the United Kingdom are modeled in Aoki, Proudman and Vlieghe (2002). When house prices rise, those not moving can use the increase in equity to secure loans that carry much lower costs than conventional unsecured consumer loans. Those moving house can also use built up equity to increase funds available for current consumption financed at low interest rates. Effectively this reduces the relative price of current consumption, encouraging households to consume. Further, if a large portion of home owners face binding liquidity constraints, the impact of access to credit through mortgage equity withdrawal could be quite large.

15. **In IMF (2002), a reduced-form error-correction model of U.K. consumption is presented that captures the impact of these channels.** This model contains a long-run cointegrating relationship between consumption, income, housing wealth, financial wealth and real interest rates. The short-run dynamics are influenced by unemployment, housing wealth, financial wealth and loans to households secured on dwellings. The model is as follows:

$$\begin{aligned}\Delta c_t = {} & -0.5 - 0.04^* \Delta un_t + 0.48^* \Delta sl_t - 0.42^* \Delta sl_{t-1} + 0.09^* \Delta hw_t + 0.05^* \Delta hw_{t-1} \\ & + 0.03^* \Delta fw_t - 0.14^*(c_{t-1} - 0.85^* y_{t-1} - 0.1^* hw_{t-1} - 0.04^* fw_{t-1} + 0.01^* r_{t-1}),\end{aligned} \tag{1}$$

where c is log consumption, un is the unemployment rate, sl is log secured liabilities, hw is log housing wealth, fw is log financial wealth, r is the real short-term interest rate, and Δ is the first difference operator.[6] The estimated coefficients illustrate that the channels through which housing has been cited as influencing consumption are important. In the long run, households treat housing as wealth that can use to support current consumption. In fact the estimates suggest that housing wealth is even more important in this regard than is financial wealth (coefficient of 0.1 on housing wealth versus 0.04 on financial wealth). In terms of the short-run dynamics of consumption, changes in housing wealth are important, as are loans secured against housing wealth. It is worth noting that the consumption model estimated above is very similar in structure and response coefficients to other empirical models of U.K. consumption.[7] This model is embedded within the MULTIMOD simulation analysis conducted below and is used to increase the coherence between the model's response and the response found in more detailed analysis of U.K. consumption behavior.

16. **Evidence presented in Bank of England (2004) suggests that the correlation between the growth in house prices and the growth in consumption expenditure may have weakened in the last few years.** Although this may indicate that the negative impact

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[6] For estimation details please see IMF Country Report No. 02/52.

[7] See HM Treasury (2003b) and Bank of England (2000).

on consumption from declining house prices may be much weaker than longer historical averages suggest, in risk analysis, like that presented in this paper, it may be prudent to consider the possible worst case scenarios. Further, the growth rate relationship becoming weaker recently does not rule out the possibility that the high correlation throughout a large portion of current phase of house-price appreciation has lead to a levels imbalance that will unwind if house price fall precipitously.

C. MULTIMOD: An Overview

17. **This section present a very simple overview of MULTIMOD, one of the IMF's multi-country models of the world economy.** A slightly more detailed description of the model is contained in Appendix 2 and the interested reader is directed to Laxton and others (1998) for a more complete description of the model's structure, estimation and properties.

18. **The U.K. block of MULTIMOD models the behavior of five types of economic agents: households, firms, nonresidents, fiscal authorities, and monetary authorities.**

- **Households** consume goods, supply labor and accumulate financial assets in the form of government bonds, housing and claims on the capital used by firms. Households are split between those whose consumption in each period is equal to a fraction of their combined financial and human wealth, and those that can consume only their disposable income. This latter group of households face liquidity constraints that prevent them from borrowing against their human wealth.

- **Firms** combine labor and capital under Cobb Douglas production technology with the objective of maximizing the net present value of their expected future stream of profits.

- International trade is motivated by the assumption that **nonresidents** view a country's composite good as being an imperfect substitute for their own home-produced composite good. This assumption leads to the modeling of trade volumes as functions of activity and relative prices. In addition to trading, nonresidents can also hold domestic financial assets or alternatively supply foreign financial assets to domestic residents depending on whether the country is a net debtor or net creditor.

- **Fiscal authorities** purchase goods and services and provide transfers that they finance through taxation or debt issue. The fiscal authorities have targets for the ratios of expenditures, transfers and debt to GDP. Cyclical variation in economic activity leads to deviations from target ratios and the tax rate on labor income is gradually adjust to restore government debt to its target relative to GDP.

- The **monetary authorities** stabilize inflation by adjusting the short-term nominal interest rate according to a Taylor-type monetary policy reaction function.

19. **MULTIMOD contains a complete description of relative prices.** Consumer prices can be functions of up to four key prices: the world price of oil, the world price of non-oil primary commodities, non-oil GDP deflators and exchange rates. MULTIMOD, like most macroeconomic policy models, relies on a reduced-form Phillips curve to characterize the behavior of core inflation. Core inflation is a function of lagged inflation, expected future inflation and goods market disequilibria. The behavior of the nominal exchange rate is governed by uncovered interest parity.

20. **Agents in MULTIMOD are required to form expectations of the future evolution of many variables.** For example, households must form expectations about future labor income and firms must form expectations about future profit streams. In MULTIMOD, it is assumed that expectations of all future variables are perfectly rational (model-consistent) except expectations of non-oil GDP inflation and possibly the exchange rate. Here the model relies on a mixture of backward-looking and model-consistent expectations to generate the empirically observed persistence.

21. **Although it is difficult to precisely capture the variation in quarterly data with a model of annual frequency, the estimation technique employed to determine MULTIMOD's parameter values has resulted in a model that broadly captures the properties in the U.K. data.** Although comparing impulse responses from backward-looking VARs to impulse responses from forward-looking models with endogenous policy reaction functions is fraught with conceptual and methodological difficulties, the impulse response results presented in Table II.1 provide a useful check. The table contains the first year responses of consumption and investment in the U.K. block of MULTIMOD to a 100 basis point increase in the short-term nominal interest rate and the average VAR responses for the first four quarters reported in IMF (2004). These results indicate that in the first year when the experiments are most comparable, MULTIMOD closely replicates the VAR results. Beyond the first year, however, consumption and investment in MULTIMOD recover very quickly because the endogenous policy reaction function takes over and quickly reduces interest rates to re-anchor inflation at the target rate. In the VAR results, the negative implications of the increase in interest rates take roughly four years to dissipate.[8]

Table II.1. First-Year Impulse Responses to a 100 Basis Point Increase in Interest Rates

	Consumption	Investment
IMF (2004) VAR	-0.28	-0.85
MULTIMOD	-0.30	-1.01

[8] Attempting to match the VAR experiment more closely by exogenizing interest rates for an extended period of time in MULTIMOD leads to instability. This result is not surprising and in fact should be expected in a rational expectations model where policy actions are required for stability.

D. MULTIMOD Simulation Analysis

22. **In this section MULTIMOD is used to examine the implications of declines in the real value of the U.K. housing stock relative to the baseline.** The assumption in the baseline is that real house prices exhibit a mild gradual decline with a portion of the required re-equilibration occurring through continued income growth. The shocks that are considered are viewed to be temporary with prices falling sharply in the first year and then gradually converging back to the baseline by the sixth year of the simulation. Initially real house price declines of 10, 20 and 30 percent are considered. Based around the most severe shock considered, in which house prices fall by 30 percent, several other scenarios are presented that examine the possible implications of other factors that might either precipitate the retrenchment or complicate the macroeconomic adjustment.

The Base-Case Model

23. **The base-case version of MULTIMOD that is used for this analysis incorporates a relatively benign characterization of the inflation process.** The Phillips curve is linear in excess demand, and the pass-through of exchange rate movements into consumption prices as well as the resistance of workers to declines in their real wages arising from import price shocks are half of the effect suggested by estimation over the 1980 to 2001 period.[9] MULTIMOD nests a Phillips curve that can be either linear or nonlinear in excess demand.[10] Although there is considerable evidence from the 1970s and 1980s suggesting that inflation was nonlinear in excess demand, the improved inflation control achieved since the early 1990s in many industrial countries suggests that this nonlinear relationship may no longer be the appropriate characterization of the inflation process. In addition, the improved credibility of central banks and their clear commitment to inflation control suggest there are fewer strategic arguments for embodying such nonlinear relationships into policy models.[11] As noted in Hunt and Isard (2003), there is mounting empirical evidence that, since about 1990, the pass-through of exchange rate movements into consumer prices is considerably less than that which was evident during the 1980s. Because MULTIMOD is annual, estimating on short sample periods is not feasible and other evidence has been used to improve its data coherence. MULTIMOD's Philips curve also embodies a channel through which workers can resist the reductions in their real consumption wage that arise from import price shocks.

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[9] For more details on this version of MULTIMOD see Hunt and Isard (2003).

[10] The nonlinearity is such that one percentage point of excess demand generates more inflationary pressure than the same amount of excess supply generates in deflationary pressure.

[11] See for example Laxton and Tetlow (1995).

Although historically the data suggest that such a channel has been important in the transmission of these types of shocks, more recent evidence again suggests that the advent of credible inflation targeting regimes has weakened this channel. Consequently, the estimated parameter that captures this effect has also been reduced by half, consistent with the change made to the exchange rate pass-through effect.

24. **Monetary policy is characterized by a Taylor-type reaction function and it is assumed that automatic stabilizers are allowed to operate, but tax rates and spending remain unchanged while aggregate demand is below aggregate supply.** The response of monetary policy to the shock will have a significant impact on its effect and the appropriate characterization of the policy reaction function is a potentially contentious issue. However, it can be cogently argued that a Taylor-type monetary policy rule is useful for illustrative purposes because of its general acceptance as a realistic characterization of how policymakers respond and as a reaction function that is relatively robust to the types of uncertainty monetary policymakers face given plausible characterizations of social preferences over inflation and output variability.[12] The Taylor-type rule used as the benchmark includes a coefficient of 0.5 on the contemporaneous output gap and coefficient of 0.5 on the one-year ahead deviation of inflation from target. The fiscal policy response is countercyclical only through automatic stabilizers and for the first four years of the shock, the model's endogenous fiscal reaction function is turned off. This is necessary to prevent the endogenous policy rule from responding to the increase in government debt above its target level by increasing tax rates while the economy is experiencing a period of excess supply. Under this shock, the baseline characterization of fiscal policy would otherwise be procyclical.

25. **The impact of the decline in house prices on consumption is augmented using the reduced-form consumption error-correction model presented in IMF (2002).** Although MULTIMOD incorporates the housing stock as part of the wealth out of which forward-looking households consume, the magnitude of housing wealth is dwarfed by the magnitude of human wealth (the net presented value of the future stream of labor income). Because policymakers respond to the shock by reducing interest rates used to discount labor income, increases in human wealth partially offset the impact of declining house values and the overall response of consumption is less that what reduced-form evidence would suggest. Consequently, to improve the model's ability to capture the impact on consumption, the error-correction consumption model from IMF (2002) is used as a guide. This consumption equation is embedded into the MULTIMOD simulations so that the general equilibrium effects coming through income, interest rates and unemployment as well as the house price declines are captured. Judgment is added to the consumption of forward-looking households until the impact of the house price shock on total consumption broadly matches that coming from the error-correction model. It is also worth noting that positive judgment is added to

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[12] See for example Clarida, Gali and Gertler (1997), Rudebusch and Svensson (1998) and Levin, Wieland and Williams (1999).

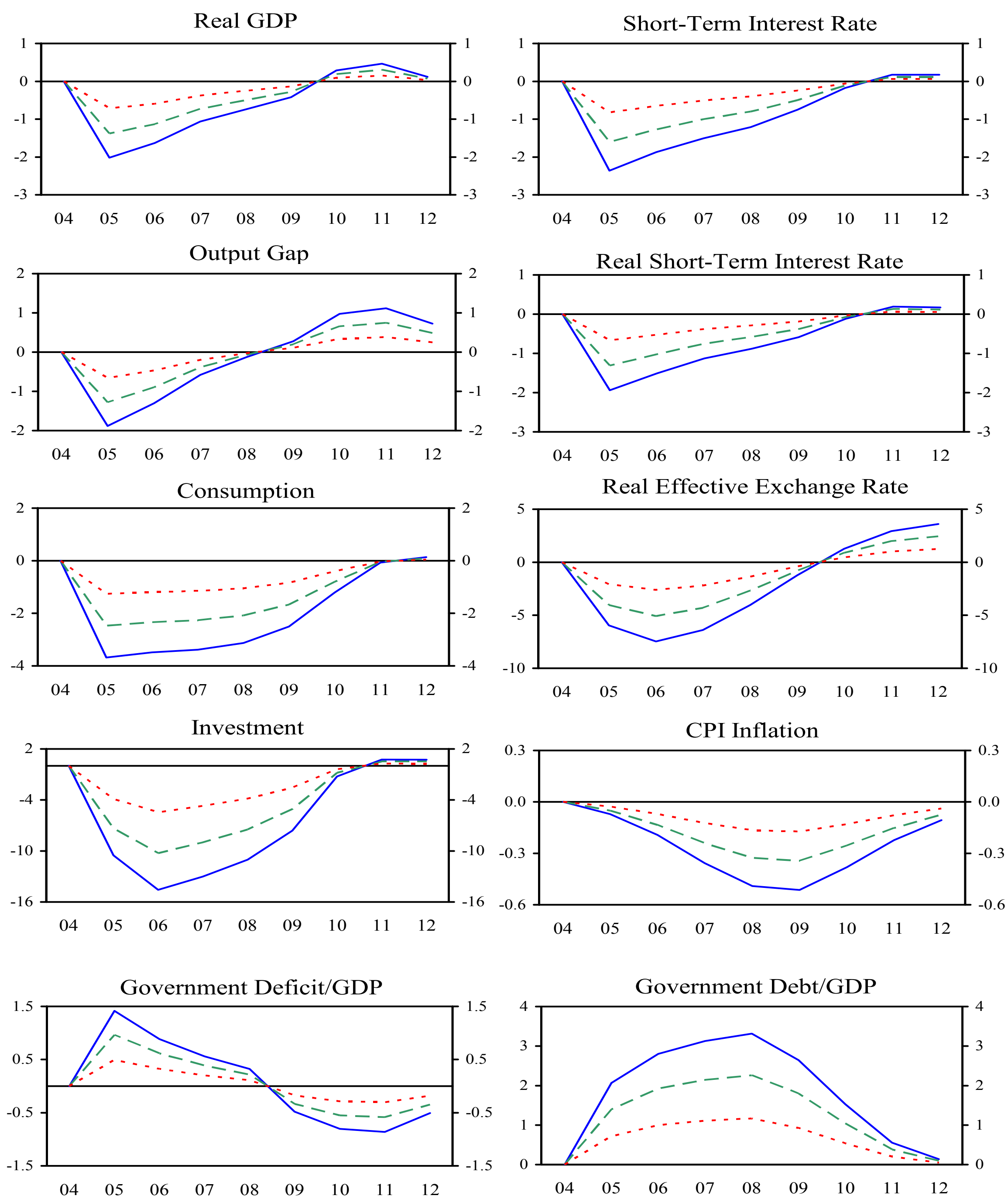
investment because given the share of residential investment in total fixed investment in the United Kingdom, the initial model response of total investment to house price declines was too large. On balance, the net impact of the added judgment on GDP roughly cancels, but the impact on the individual components of GDP is now more consistent with how the shock would be expected to play out.

The Base-Case Simulations

26. **Declines in real house prices have an immediate negative impact on real activity.** The base-case response to shocks of 10, 20, and 30 percent are presented in Figure II.4. Initially, the house price declines increase the user cost of capital in housing through declines in the current and expected real price of housing and, consequently, residential investment falls. The declines in housing wealth and the judgment added to match the reduce-form error-correction consumption model reduces the consumption of forward-looking households. In turn, the consumption of liquidity-constrained households declines as their disposable income falls. Weaker real activity has knock-on effects for future profit streams and business fixed investment falls as well.

27. **The monetary authority responds quickly to the shock and nominal interest rates decline sharply in the first year.** In the case of the 30 percent decline in house prices, the nominal interest rate declines by about 240 basis points. When the house price declines are smaller, so are the responses of short-term interest rates. With real interest rates falling, the real exchange rate depreciates. This easing in monetary conditions helps to support real activity and output begins to recover back toward baseline in the second year. After five years, the maximum cumulative loss in GDP is roughly 6 percent. With investment falling in the shock, potential output also declines and the maximum cumulative output gap after five years is lower, at roughly 4 percent. In the first year, CPI inflation only declines slightly below baseline as positive inflationary effects from the depreciation in the exchange rate partially offset the disinflationary impact from excess supply. With tax rates held fixed, expenditure on automatic stabilizers increasing, and revenue falling because of weaker activity, the fiscal position deteriorates. Under the 30 percent decline in house prices, the ratio of government debt to GDP ratio rises by just over 3 percentage points by the fourth year.

Figure II.4. Impact of Potential Declines in Real House Prices
Solid line 30 percent, Dashed Line 20 Percent, Dotted Line 10 Percent
Percent or Percentage Point Deviation from Baseline



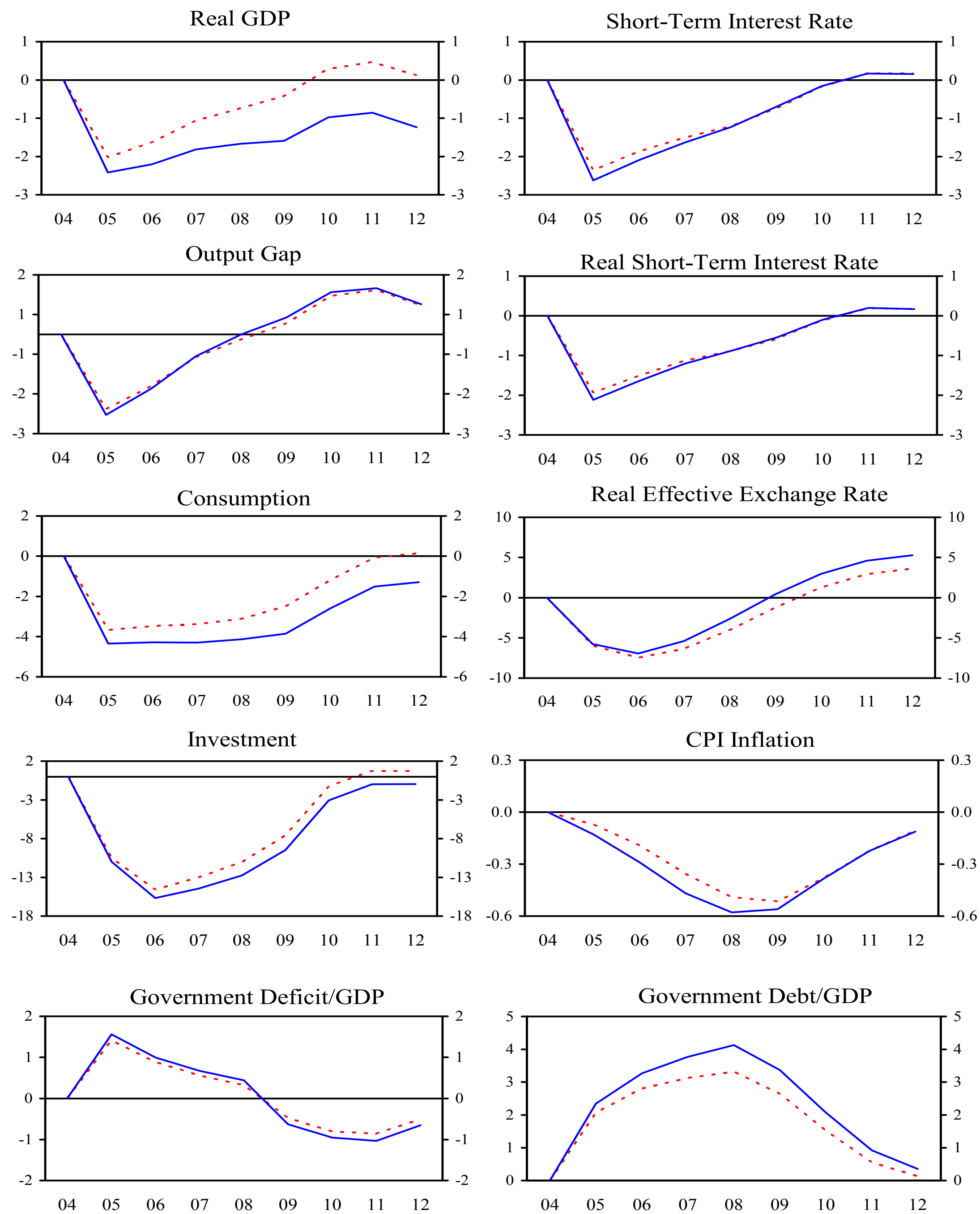
Source: MULTIMOD.

Expectations of slower productivity growth

28. **If recent house price appreciation has been fueled by inflated expectations of productivity growth, it is possible that a realignment of expectations could precipitate the retrenchment in house prices.** Alternatively, changing expectations of productivity growth could complicate the macroeconomic adjustment to a sharp fall in house prices. To examine this, a shock to productivity is added to the house price decline of 30 percent. The productivity shock considered reduces future total factor productivity growth temporarily by 0.25 percentage points for five years, after which time productivity growth returns to baseline. The results for the key macro variables from this experiment are graphed in Figure II.5 along with the results from the house price shock alone.

29. **Not surprisingly, with productivity declining at the same time as house prices fall, the impact on GDP is larger.** Output declines by almost 2½ percent in the first year. While the cumulative output loss is larger because of the supply component, the cumulative output gap after five years is very similar to the base-case. With forward-looking households and firms responding quickly once they realize productivity prospects over the medium term are lower than expected, monetary policy eases by more to support aggregate demand. Consequently, the net impact on inflation and the output gap is similar to the base case. The fiscal position, however, deteriorates even more with the debt-to-GDP ratio rising by over 4 percentage points by the fourth year. In part this reflects the permanently lower level of GDP. In summary, provided the monetary authority recognizes the supply component and eases appropriately, a realignment of expected productivity growth of the magnitude considered does not greatly complicate the macro adjustment to a decline in house prices. However, the fiscal position deteriorates further.

Figure II.5. A 30 Percent Decline in Real House Prices and Slower Productivity Growth (solid), Base-Case Simulation (dashed)
Percent or Percentage Point Deviation From Baseline



Source: MULTIMOD.

Alternative fiscal responses

30. **If a sharp decline in house prices were to materialize, there may be some temptation to bolster demand through temporary fiscal initiatives.** This, however, would only worsen the deterioration in the cumulative deficit and debt positions. To illustrate the macroeconomic implications of alternative fiscal responses, the 30 percent decline in house prices is simulated under two alternative fiscal responses relative to the base case. Under the first alternative, to help support activity, fiscal policy is eased through a cut in labor income taxes by an amount that roughly doubles the increase in the debt-to-GDP ratio relative to the base case.[13] For the second alternative, the model's endogenous fiscal policy rule, which seeks to stabilize the debt-to-GDP ratio by adjusting taxes, is switched on. Under both of these alternatives, monetary policy is allowed to respond endogenously according to the specified Taylor-type interest rate reaction function. The results for the key macro variables under these alternative fiscal responses are graphed in Figure II.6 along with the results under the base-case fiscal assumptions.

31. **With monetary policy responding endogenously, alternative fiscal responses do not have a material affect on the macroeconomic outcome, but debt and deficit profiles could be significantly different.** With the model's endogenous fiscal rule operating (dashed line), a tighter fiscal stance than in the base case reduces the cumulative increase in the government's deficit-to-GDP ratio by 2 percentage points and cuts in half the increase in the debt-to-GDP ratio. The net impact on GDP, however, is negligible as tighter fiscal policy is almost completely offset by easier monetary policy. With the fiscal tax rule operating on labor income taxes, consumption is weaker. However, lower interest rates and a weaker real exchange rate lead to higher investment and net exports. CPI inflation is only marginally lower in the medium term. Under the second alternative, in which tax rates are lowered such that the accumulation in debt roughly doubles (dotted line), real activity is only marginally stronger as higher interest rates largely offset the impact of lower taxes. The path for CPI inflation is also only slightly higher under the easier fiscal stance.

32. **These simulation results would appear to argue strongly for allowing monetary policy to respond to the shock and keeping fiscal policy focused on satisfying the golden rule and the sustainable investment rule.** In doing so fiscal policy would avoid the risk of undermining the credibility of the fiscal framework. For example, if equilibrium real interest rates were to increase temporarily, but persistently, as a result of the missed fiscal objectives, then the negative impact of the shock could be larger and much longer lived. There are potentially significant benefits to relying on monetary policy alone to offset the impact of a sharp decline in house prices.

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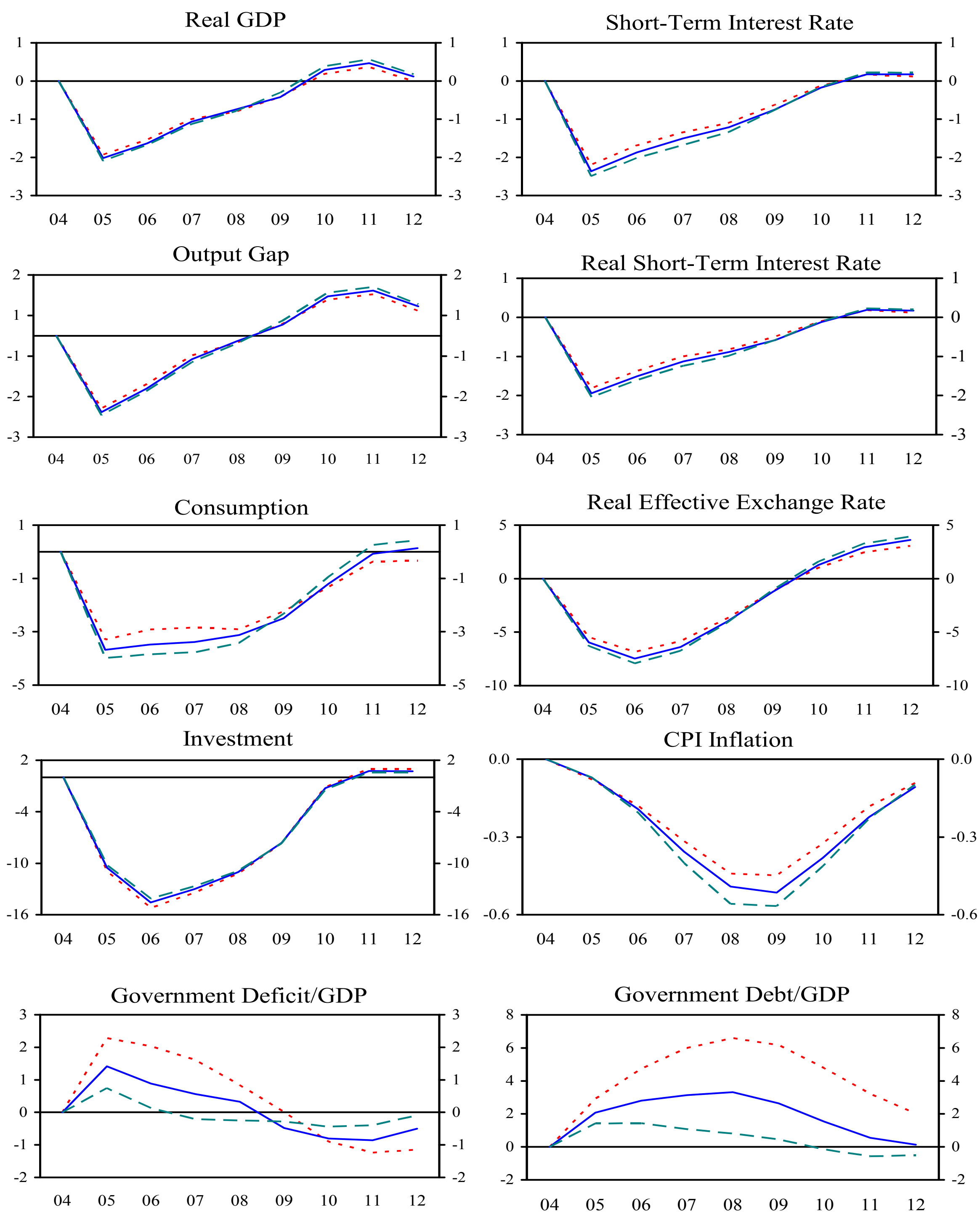
[13] The fiscal easing was implemented via a cut in labor income taxes rather than increased expenditure because this shock is falling on household wealth and income, and reducing income taxes is the most direct way to offset this.

Figure II.6. Alternative Fiscal Responses
Base Case (solid), Easier Fiscal Stance (dotted), Tighter Fiscal Stance (dashed)
Percent or Percentage Point Deviation From Baseline



Source: MULTIMOD.

A less benign inflation process

33. **Although it would appear prudent to rely on a monetary policy response alone should a sharp retrenchment in house prices materialize, it is also important to consider the potential risks to the monetary policy framework.** The base-case version of MULTIMOD used for the simulations embodies a somewhat benign structure for the inflation process. It contains mild pass-through of exchange rate movements into CPI inflation, low resistance on the part of workers to declines in their real consumption wage and a linear response of inflation to goods market disequilibria. An interesting question to ask is what might happen if the monetary authority based their initial interest rate response to the shock on these assumptions, but it turned out that the inflation process was in fact nonlinear, the pass-through was stronger for depreciations than for appreciations (asymmetric), and workers were more resistant to declines in their real consumption wages. This would appear to be stacking the deck as much as possible against the monetary authority.

34. **To consider the implications of the monetary authority underestimating the difficulty of its inflation control task, the following simulation experiment is run.** First, the monetary policy response for the first year and a half is set exogenously to the response achieved under the benign inflation structure when house prices fall by 30 percent and fiscal policy is tighter than in the base-case simulation. However, judgment is added to the inflation response in the first two years so that it is identical to that which would be achieved under full pass-through of exchange rate movements into consumer prices, more resistance to declines in the real consumption wage, the nonlinear Phillips curve and the aggressive monetary policy easing.[14] The results of this experiment are graphed in Figure II.7 along with the results under the benign inflation assumption that generated the initial policy response.

35. **Even if the inflation process turns out to be much less benign than assumed in the initial easing in monetary policy, there appears to be little risk that the credibility of the inflation targeting framework would be threatened.** In the first year, inflation now rises above baseline by just over 1 percentage point and accelerates further to just over 1.2 percentage points above baseline in the second year. Even holding the policy rate fixed for the first half of the second year, the increase in the last half would see the policy rate rising back close to baseline. The policy rate would then remain close to baseline thereafter.

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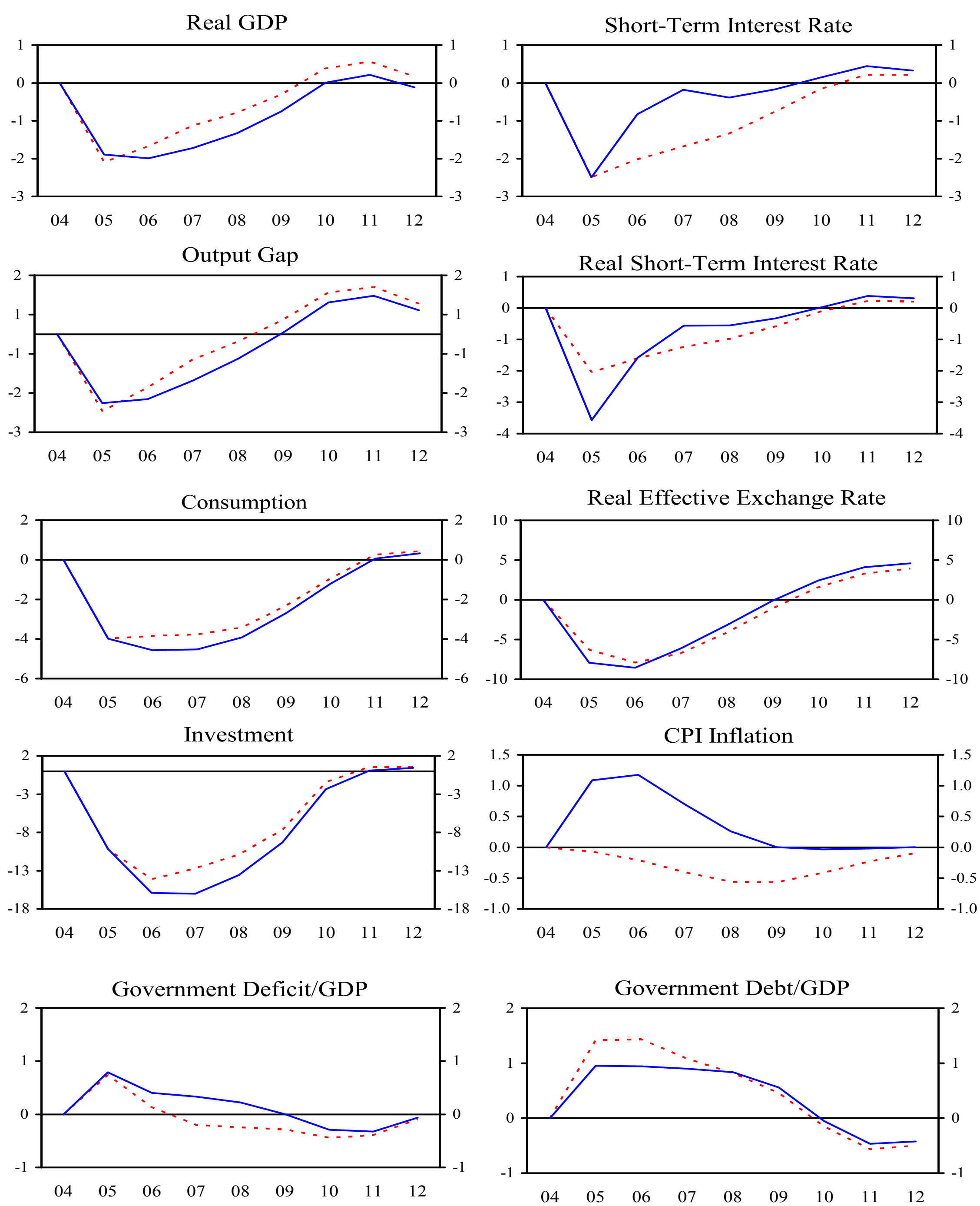
[14] This experiment stacks the deck more against the monetary authority than simply setting interest rates exogenously and using the version of the model with the nonlinear Phillips curve and the full pass-through. The way the experiment is conducted here, the pass-through effect is asymmetric and the monetary authority does not benefit as much from deflationary pressures coming from the appreciation in the exchange rate that occurs in the third year and beyond.

Figure II.7. Less Benign Inflation Process Than Assumed by the Initial Monetary Policy Response (solid), Benign Inflation Process (dotted)
Percent or Percentage Point Deviation From Baseline



Source: MULTIMOD.

It is useful to keep in mind that with higher inflation, real interest rates are still well below baseline helping to offset the negative effect of the shock on aggregate demand. These results suggest that if monetary policy alone responded aggressively to the shock and in doing so was underestimating the difficulty of its inflation control task, and remained ignorant of the mistake for a year and half, inflation in the second year would accelerate to roughly three percent, given the baseline. Such an acceleration in inflation would not require a letter of explanation from the Governor to the Chancellor. Consequently, this simulation suggests that there is very little risk to the monetary policy framework of an aggressive monetary response to a sharp decline in house price.

E. Conclusions

36. **Analysis suggests that the range of potential overvaluation in house prices is wide.** Some traditional techniques for estimating the sustainable level of house prices suggest that overvaluation could be in the range of 25 to 60 percent. At the same time, cogent arguments can be made that improvements in monetary and fiscal policy frameworks have increased sustainable prices beyond what these linear estimation techniques can capture, suggesting there is little, if any, overvaluation at all. From a policymaker's perspective, there does appear to be some risk that house prices are overvalued and, consequently, the possibility of some correction cannot be ruled. Policymakers need to be cognizant of the risk of such a correction and the possible implications.

37. **Simulation analysis of the impact of declining house prices illustrates that the macroeconomic consequences could be significant.** Real house price declines of between 10 and 30 percent could lead to cumulative losses in GDP relative to baseline ranging between 2 and 6 percent after five years, provided policy responds actively to offset the impact. If the house price decline is accompanied by a realignment of expectations of future productivity growth, aside from the real supply effects of such a realignment, such a development would not appear to complicate significantly the macro adjustment process. This is conditional, of course, on the monetary authority correctly perceiving the shock and responding accordingly. Overall these results may be indicative of the largest impact that declining house prices could have because consumption in these simulations responds as it has historically to variations in house prices. Although there are some indicators suggesting that this relationship may be weakening, when conducting stress test like the one considered in this paper, it is prudent to focus on the worst possible outcomes, particularly when evidence to the contrary is so preliminary.

38. **Even if house prices declined by a large amount and households responded strongly, decisive policy responses can significantly mitigate the impact, with GDP growth falling below baseline in only the first year of the shock.** If real house prices were to fall by 30 percent, either a sharp reduction in interest rates coupled with automatic stabilizers or a combination of lower interest rates, lower labor income taxes, and automatic stabilizers result in GDP growth declining by only 2 percentage points in the first year.

Supportive policy would subsequently result in above-baseline growth for the next four years as the level of economic activity is returned to baseline.

39. **Although both monetary and fiscal policy can effectively mitigate the impact of declining house prices, it would appear sensible to allow monetary policy alone to respond.** If fiscal policymakers reduced income tax rates to help support household income and the monetary policy response factored this in, the broad macroeconomic picture would remain largely unchanged, but the fiscal position would deteriorate even more than it does when only fiscal automatic stabilizers operate. If, on the other hand, fiscal policy focused more on safeguarding fiscal objectives than assumed in the base-case simulation, monetary policy could largely offset the broad macroeconomic impact. The resulting improvement in the fiscal position would reduce the risk of violating the golden rule or the sustainable investment rule, and thereby help maintain the credibility of the fiscal framework. With the effect of a sharp fall in house prices largely falling on household consumption, monetary policy has a powerful offset because of the high proportion of variable-rate mortgages, and, consequently, it is highly effective under this shock. At the same time, the risk to the monetary framework of relying exclusively on monetary policy to respond to the shock appears to be quite low.

An Error-Correction Model of House Prices

1. This section presented the updated estimates of the error-correction model of U.K. house prices reported in IMF (2003). The empirical methodology used in this analysis was to estimate a reduced-form equation of log real house prices (*p)* as a function of log real disposable income per household (*y)*, and real inter-bank rates (*r*).[1] The estimation employed an error-correction model where real house prices adjust to their long-run equilibrium while responding to short-run movements in house prices in previous quarters, interest rates and real income per household.

2. Data on house prices and number of households were obtained from the Office of the Deputy Prime Minister, real disposable income from the National Statistics Office and three month inter-bank rates from the Bank of England.[2] We estimated the model over three sample periods, 1972Q4 to 1999Q4, 1972Q4 to 2001Q3 and 1972Q4 to 2004Q2.

3. All series are I(1), i.e., contain a unit root, and real house prices, real income and interest rates co-integrate (Tables II.A.1, II.A.2 and II.A.3). The model shows a long-run income elasticity of house prices larger than that from previous literature and high degree of persistence in real house prices as far as two quarters back (Table II.A.4). The model estimated over the 1972Q4 to 1999Q4 period is presented below.[3] Estimation results over the other sample periods are available upon request.

$$
\begin{aligned}
\Delta p = {} & \underset{(3.96)}{0.443} * \Delta p_{t-1} + \underset{(3.21)}{0.382} * \Delta p_{t-2} - \underset{(-0.61)}{0.070} * \Delta p_{t-3} - \underset{(-2.56)}{0.006} * \Delta r_{t-1} - \underset{(-0.18)}{0.000} * \Delta r_{t-2} + \underset{(2.21)}{0.005} * \Delta r_{t-3} \\
& + \underset{(0.20)}{0.033} * \Delta y_{t-1} + \underset{(0.03)}{0.005} * \Delta y_{t-2} + \underset{(0.95)}{0.167} * \Delta y_{t-3} - \underset{(-1.88)}{0.019} * (p + \underset{(3.15)}{0.060} * r - \underset{(-3.61)}{1.912} * y + \underset{(3.88)}{17.53})_{t-1}
\end{aligned}
$$

[1] Our model is a reduced form equation that can be derived from two structural equations (for supply and demand). Since the model does not contain a quantity indicator, as it would in an structural demand equation, it is not possible to recover the parameters of the housing demand schedule.

[2] Real house prices are calculated by deflating the ODPM house price index by the Retail Price Index (RPI). Nominal interest rates using a 8-quarter moving average of RPI.

[3] T-statistics in parenthesis. All variables except interest rates are in logs, Δ denotes first differences, *p* represents real house prices, *r* real short-term interest rates, and *y* represents real income per household.

Table II.A.1. Unit Root Tests 1972:4–1999:4

Variable	Test Speficication	Lag	ADF t-statistic
Real House Prices	Levels	5	-1.10
	1st Differences	4	-3.25 **
Real Disposable Income per Household 1	Levels	1	3.08
	1st Differences	0	-13.01 **
Real Disposable Income per Household 2	Levels	1	3.36
	1st Differences	0	-6.70 **
Real 3m Interest Rate	Levels	1	-1.93
	1st Differences	0	-7.39 **
Null Hypothesis: Series has a unit root			
Test critical values:	1% level	-2.59	
	5% level	-1.94	
	10% level	-1.62	

*,** Denote rejection of null hypothesis at 5% and 1% significance level, respectively.
Lag length is chosen using the Schwart Information Criterion

Table II.A.2.a. Lag Order Selection Criteria

The lag length of the VAR system used to perform cointegration analysis was selected using the criteria presented below.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-117.8	NA	0.0	2.3	2.4	2.3
1	359.6	918.3	0.0	-6.6	-6.3	-6.5
2	404.6	84.0	0.0	-7.3	-6.8*	-7.1*
3	415.5	19.7*	1.30e-07*	-7.3*	-6.6	-7.0
4	420.3	8.41	0.0	-7.3	-6.3	-6.9

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwartz information criterion
HQ: Hannan-Quinn information criterion

Table II.A.2.b. Lag Order Selection Criteria

The lag length of the VAR system used to perform cointegration analysis was selected using the criteria presented below.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-128.9	NA	0.0	2.5	2.6	2.5
1	357.2	935.3	0.0	-6.6	-6.3	-6.5
2	402.9	85.2	0.0	-7.3	-6.7*	-7.1*
3	413.1	18.5*	1.36e-07*	-7.3*	-6.5	-7.0
4	417.7	8.1	0.0	-7.2	-6.2	-6.8

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwartz information criterion
HQ: Hannan-Quinn information criterion

Table II.A.3. Cointegration Test

Hypothesized Number of Cointegrating Vectors	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
A. Model with Real Disposable Income 1				
None *	0.21	41.41	35.19	0.01
At most 1	0.08	16.69	20.26	0.14
At most 2	0.07	7.97	9.16	0.08
B. Model with Real Disposable Income 2				
None **	0.22	42.11	34.91	41.07
At most 1	0.08	15.69	19.96	24.60
At most 2	0.07	7.22	9.24	12.97

*(**) denotes rejection of the hypothesis at the 5%(1%) level

An Overview of MULTIMOD

1. This appendix present a very simple overview of MULTIMOD, the IMF's multi-country model of the world economy. A slightly more detailed description of the Model is contained in the appendix and the interested reader is directed to Laxton and others (1998) for a more complete description of the model's structure, estimation and properties.

2. MULTIMOD has a two-tired structure. The first tier is a static representation that describes the long-run equilibrium of the economy where countries can be characterized as either net debtors or net creditors. The steady-state model is derived in a manner that makes it exactly consistent with the behavioral structure that determines the dynamic adjustment towards this full stock-flow equilibrium. This steady-state representation can be used to conduct comparative static analysis of the impact of permanent shocks to the economy. It also provides the terminal conditions exploited by the solution algorithm for solving the complete model. MULTIMOD's second tier is a dynamic representation that describes the transition path that the economy takes to the long-run equilibrium.

3. For the simulations presented in this paper we use a slightly modified version of MULTIMOD Mark IIIB. It contains individual blocks for four industrial countries: the United Kingdom, the United Sates, Japan, and Canada. There are also two aggregate industrial country blocks. The first consists of the Euro area and the second consists of all remaining industrial countries. Each industrial country/block has an identical structure, but the estimated parameter values may vary. Developing countries are aggregated into two blocks. The main developing country block is made up of net debtor countries. The remaining developing country block consists of net creditor countries that are primarily those that export large quantities of oil. Both the developing country blocks are very simple with the key distinguishing feature being that the net debtor countries face a borrowing constraint. Analysis can be done with either individual industrial country/blocks or the complete model of the world economy.

4. Each industrial country block models the behavior of five types of economic agents: households, firms, nonresidents, fiscal authorities and monetary authorities. Each industrial country produces a single composite tradable good. Nonresidents perceive this composite tradable good to be an imperfect substitute for their own home-produced composite tradable good. The main developing country model as well as the international trade accounts distinguish among three types of tradable goods: the composite good, oil, and non-oil primary commodities. The main developing country model also includes a non-tradable manufactured good.

Households

5. In MULTIMOD, households consume the traded goods, supply labor and accumulate financial assets in the form of government bonds and claims on the capital used by firms. In the industrial country blocks, household behavior is based on an extended version of the Blanchard (1985) finite-planning-horizon model. Because current generations are

disconnected from future generations, the model embodies non-Ricardian features where changes in government savings can affect national savings, interest rates and asset accumulation.

6. The basic Blanchard framework for household behavior has been extended along several dimensions. First, households are split between those whose consumption in each period is equal to a fraction of their combined financial and human wealth and those that can consume only their disposable income each period. This latter group of households face liquidity constraints that prevent them from borrowing against their human wealth (the present value of their expected life-time labor income). Further, households' labor income profiles are age dependant. These extensions allow changes in taxes to have more short-term impact on economic activity and mean that population dynamics have important implications for consumption and saving. Households' supply of labor is assumed to be perfectly inelastic with respect to the real wage.

Firms

7. Firms in MULTIMOD combine labor and capital under Cobb Douglas production technology with the objective of maximizing the net present value of their expected future stream of profits. Firms are assumed to be perfectly competitive. Capital accumulation is based on the *q* theory of Tobin (1969) with the addition of costly adjustment. Adjustment costs are quadratic around the steady-state level of investment. Differences between the market price of capital and its replacement cost lead firms to change their desired level of capital. Costly adjustment means that firms adjust investment flows gradually to achieve their new desired level for the capital stock.

Nonresidents and international trade

8. Unlike the explicit optimization theory determining the behavior of households and firms, international trade is motivated by the assumption that nonresidents view a country's composite good as being an imperfect substitute for their own home-produced composite good. This assumption leads to the modeling of trade volumes as functions of activity and relative prices. Activity variables are constructed from input/output tables allowing for different import propensities in consumption, investment, government expenditure and exports. Domestic activity is the scale variable driving imports and nonresident activity is the scale variable driving exports. In addition to trading, nonresidents can also hold domestic financial assets or alternatively supply foreign financial assets to domestic residents depending on whether the country is a net debtor or net creditor. It is assumed that the financial assets held or supplied by nonresidents are government bonds. Global consistency ensures that worldwide trade flows balance and global net foreign asset positions sum to zero.

Fiscal authorities

9. The fiscal authorities in MULTIMOD purchase goods and services and provide transfers that they finance through taxation or debt issue. The fiscal authorities have targets for the ratios of expenditures, transfers and debt to GDP. Cyclical variation in economic activity leads to deviations from target ratios. To restore government debt to its target relative to GDP, the fiscal authorities gradually adjust the tax rate on labor income. Because households supply labor inelastically, this labor income tax is effectively a lump sum tax. Transfer and expenditure target ratios are automatically restored as economic activity stabilizes. The Mark IIIB version also incorporates endogenous fiscal transfers that respond to the degree of slack in economy and thus act as automatic stabilizers.

Monetary authorities

10. In MULTIMOD, the role of the monetary authority is to provide the nominal anchor. Which is achieved by targeting the rate of inflation. The monetary authorities adjust the short-term nominal interest rate according to a Taylor-type monetary policy reaction function. The short-term nominal rate is adjusted relative to a neutral nominal rate in response to the gap between inflation and its target rate and the gap between current output and potential output. The response coefficient on the inflation gap is set at 0.5 and the response coefficient on the output gap has been set to 0.5. The model user can choose whether the inflation and output gap terms in a Taylor-type policy rule are lagged, contemporaneous or one-period-ahead forecasts. This version of the model permits solutions with different countries/blocks choosing different long-run target rates of inflation.

Prices

11. MULTIMOD contains a complete description of relative prices. Industrial country prices can be functions of up to four key prices: the world price of oil, the world price of non-oil primary commodities, non-oil GDP deflators and exchange rates. The world price of oil is exogenous and the world price of non-oil primary commodities adjusts instantaneously to clear the non-oil commodities market. The behavior of the non-oil GDP deflator (referred to as core inflation) is described by a reduce-form Phillips curve and uncovered interest parity determines exchange rate behavior. How these prices are combined to generate the full of set relative prices depends on the individual country's/block's trading relationship with the rest of the world.

12. MULTIMOD, like most macroeconomic policy models, relies on a reduced-form Phillips curve to characterize the behavior of core inflation in the industrial countries. Core inflation (the rate of inflation in the non-oil GDP deflator) is a function of lagged inflation, expected future inflation and a goods market disequilibria. The natural-rate hypothesis is imposed in the estimation of parameter values. The model nests both a linear and nonlinear inflation process which the model user can switch between. The nonlinearity is such that inflation is more responsive to excess demand in the labor market than it is to excess supply. Although, the specification does not include explicit wage rates, the dynamics of inflation

and inflation expectations are characterized in a manner that implicitly recognizes important features of wage-setting behavior (in particular, contracting lags and wage-push elements). Further, a real-wage catch-up term has been included in the Phillips curve to capture the effect of households resisting the erosions in the purchasing power of their real wage that can arise from changes in import prices.

13. The behavior of the nominal exchange rate is governed by uncovered interest parity. The exchange rate will deviate from the expected future exchange rate in proportion to the gap between the domestic short-term interest and the foreign short-term interest. All exchange rates are expressed in terms of the United States currency.

Expectations

14. The agents in MULTIMOD are required to form expectations of the future evolution of many variables. For example, households must form expectations about future labor income and firms must form expectations about future profit streams. In MULTIMOD, it is assumed that expectations of all future variables are perfectly rational (model-consistent) except expectations of non-oil GDP inflation and possibly the exchange rate. Here the model relies on a mixture of backward-looking and model-consistent expectations to generate empirically observed persistence.

References

Aoki, K., J. Proudman, and G. Vlieghe, 2002, "House Prices, Consumption, and Monetary Policy: a Financial Accelerator Approach," *Bank of England Working Paper No.169*.

Bank of England, 2000, *Economic Models at the Bank of England: September 2000 Update*, London: Bank of England.

Bank of England, 2004, "Inflation Report," Bank of England (November).

Barker, K., 2004, "Delivering Stability: Securing Our Future Housing Needs," HM Treasury.

Barker, K., 2005, "The Housing Market and the Wider Economy," Speech at the Institute for Economic Affairs State of the Economy Conference.

Blanchard, Olivier J., 1985, "Debts, Deficits and Finite Horizons," *Journal of Political Economy*, Vol. 93 (April), pp. 223–47.

Clarida, R., J. Gali and M. Gertler, 1997, "Monetary Policy Rules in Practice: Some International Evidence," NBER Working Paper No. 6254.

HM Treasury, 2003a, "U.K. Membership of the Single Currency: An Assessment of the Five Economic Tests," HM Treasury, June 2003.

HM Treasury, 2003b, "Housing, Consumption and EMU," EMU Studies, HM Treasury, June 2003.

Hunt, B., and P. Isard, 2003, "Some Implications for Monetary Policy of Uncertain Exchange Rate Pass-Through," *Scottish Journal of Political Economy*, Vol. 50, No. 5, pp 567–584.

IMF, 2002, "Why has U.K. household consumption been so strong," in *United Kingdom*: *Selected Issues*, IMF Country Report No. 02/52.

IMF, 2003, " An analysis of house prices in the United Kingdom," in *United Kingdom*: *Selected Issues*, IMF Country Report No. 03/47.

IMF, 2004, "The interest sensitivity of U.K. demand," in *United Kingdom*: *Selected Issues*, IMF Country Report No. 04/55.

Laxton, D., P. Isard, H. Faruqee, E. Prasad, and B. Turtelboom, 1998, "MULTIMOD Mark III: The Core Dynamic and Steady-State Models," IMF Occasional Paper No. 164.

Laxton, D., D. Rose, and R. Tetlow, 1994, "Monetary Policy, Uncertainty and the Presumption of Linearity,' Technical Report No. 63, Ottawa: Bank of Canada.

Levin, A., V. Wieland and J. Williams, 1999, Robustness of Simple Monetary Policy Rules Under Model Uncertainty," in *Monetary Policy Rules* ed. By John Taylor, Chicago: University of Chicago Press and NBER, pp 263–316.

Miles, D., 2004, "The U.K. Mortgage Market: Taking a Longer-Term View," HM Treasury.

Nickell, Stephen, 2004, "Household Debt, House Prices and Consumption Growth," Speech at Bloomberg in London.

Otrok, C., and M. Terrones, 2005, "House Prices, Financial Returns and Macroeconomic Fluctuations: International Evidence," forthcoming IMF Working Paper.

Rudebusch, G. and L. Svensson, 1999, "Policy Rules for Inflation Targeting," in *Monetary Policy Rules* ed. By John Taylor, Chicago: University of Chicago Press and NBER, pp 263–316.

Tobin, James, 1969, "A General Equilibrium Approach to Monetary Theory," *Journal of Money Credit and Banking,* Vol. 1 (February), pp. 15–29.

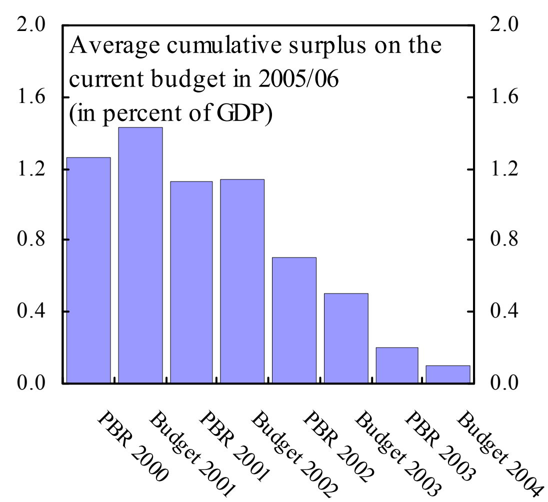
III. The Implementation of the Golden Rule Over the Cycle[1]

A. Introduction

1. **The golden rule is a cornerstone of the U.K.'s fiscal framework.** Introduced in 1998, it states that over the economic cycle, the government should borrow only to invest and not to fund current spending. (A more technical definition of the golden rule is that over the cycle, the cumulative balance on the current budget as a percentage of GDP should be non-negative; progress against meeting the rule is measured by the average balance on the current budget as a percentage of GDP since the start of the cycle.) As explained in Balls and O'Donnell (2002), the rationale for the above specification of the golden rule is to remove any bias against capital spending and to ensure fairness between generations.

2. **Since its introduction, the U.K.'s golden rule has prompted numerous discussions in academic and policy circles, as well as the media.** In the theoretical literature, for instance, Kell (2001) has evaluated the U.K.'s golden rule against a benchmark of an "ideal" fiscal rule, concluding that the rule measures strongly in many respects. On the policy front, the performance of the golden rule has been discussed extensively and regularly by the HM Treasury in its Pre-Budget (PBR) and Budget reports, as well as by the Institute of Fiscal Studies (IFS) in its annual "Green Budget." In the media, over 2000 news reports have mentioned the golden rule during the past year.

3. **The recent wave of interest has been partly due to the fact that as the cycle has come close to an end, the safety margin for meeting the rule has shrunk and the risk of breaching it has risen.** According to the HM Treasury's estimates and projections, the current economic cycle started in 1999/2000 and will finish in 2005/06. Since the start of the cycle, however, the projected average balance on the current budget in 2005/06, which could be interpreted as the safety margin for meeting the golden rule, has declined from over 1 percent of GDP in the 2000 PBR to about 0.1 percent of GDP in the 2004 PBR (see chart). On one hand, the depletion of the safety margin with the unfolding of the economic cycle is not surprising—in fact, one could argue that the safety margin has served its purpose and should be zero at the end of the cycle. On the other hand, however, the low level of the safety margin has increased the risk of breaching the golden rule if budgetary



[1] Prepared by Petya Koeva.

projections for the remaining part of the cycle do not materialize; either due to an adverse output shock or to any other source giving rise to forecast errors.

4. **Stepping back from the current conjuncture, this paper poses the following questions.**

> **Question 1**. *What is the relationship between the size of the safety margin and the risk of breaching the golden rule?* The objective of the paper is to quantify the (ex-ante) safety margin *m* needed to ensure that the probability of violating the rule is less than *p* percent over the cycle.
>
> **Question 2.** *How does the size of the safety margin depend on the characteristics of the likely shocks that hit the economy?* The approach of the paper is to consider the impact of output, asset price, and discretionary policy shocks on the size of the safety margin (for a given probability of meeting the golden rule).
>
> **Question 3.** *What are the policy implications of subscribing to the above probabilistic approach to the golden rule?* In addressing this question, the paper builds on the answers to Questions 1 and 2, as well as on existing proposals to update the U.K.'s fiscal framework (see Emmerson, Frayne, and Love (2004)).

5. **The rest of the paper is organized as follows.** Section B provides additional background on the introduction, formulation, and implementation of the golden rule. Section C describes the methodology used to tackle Questions 1 and 2, which is to simulate a reduced-form stochastic model of the current budget balance. Section D presents and discusses the simulation results, i.e., the size of the safety margin needed to meet the golden rule under various assumptions about the type and magnitude of shocks that affect the fiscal balance. Section E concludes.

B. Background and Motivation

6. **Lessons from past policy experience made an important contribution to the design of the U.K. fiscal framework**. As discussed in HM Treasury (1997), the sharp deterioration in the fiscal balance between the late 1980s and the early 1990s—which was partly attributed to large errors in estimating the level of output relative to its trend—taught policy-makers two key lessons. First, it is critical to take a prudent approach by building in a margin for uncertainty in the fiscal projections. Second, it is important to be open and transparent by establishing fiscal rules that remain stable over the economic cycles and allow objective ex post evaluation. The U.K.'s fiscal framework, and the golden rule, in particular, incorporate these two principles in order to help avoid past mistakes. Balls and O'Donnell (2002) elaborate that "*of course, it is not possible to remove all source of uncertainty. But by taking a prudent approach, including using cautious assumptions and publishing cyclically adjusted estimates of the key fiscal indicators, the risk of mistakes can be minimized*."

7. **What are the margins of caution in the current implementation of the golden rule?** Several elements play a role in incorporating a margin for uncertainty in the fiscal projections, and, therefore, the golden rule. In principle, the combination of these margins of caution should accommodate likely adverse shocks within the fiscal rule.

- *Cautious assumptions*. The forecasts for revenue and expenditures use 11 key assumptions—on privatization receipts, trend growth, claimant unemployment, interest rates, equity prices, VAT receipts, consistency of price indices, composition of GDP growth, funding, oil prices, and underlying market share of smuggled tobacco—that are audited on a three-year rolling basis by the National Audit Office (NAO) to be reasonable and cautious. The auditing of the trend growth assumption was prompted by errors in the estimates of the level of trend output in the late 1980s. The VAT assumption was included mainly because receipts in this tax category consistently underperformed relative to forecasts in the early 1990s.

- *Annually Managed Expenditure (AME) margin*. The expenditure projections include a buffer should outturns for AME programs turn out to be worse than expected.

- *Safety margin*. Fiscal policy is also set so that the current budget shows an ex-ante surplus, i.e., a safety margin for meeting the golden rule.

- *Alternative scenario*. Finally, the PBR and Budget documents present an alternative projection of the cyclically-adjusted current balance and the average surplus on the current budget in which trend output is assumed to be 1 percent lower than in the main projections. Under this cautious scenario, the average surplus on the current budget was shown to be negative in the 2004 Pre-Budget Report.

8. **In spite of these margins of caution, the ex-post realizations of the current balance reveal that the risk of breaching the golden rule at the end of the cycle can still be non-trivial.** As already mentioned, the key indicator of progress against the golden rule, i.e., the average current budget balance since the start of the cycle, is projected by the HM Treasury to be only 0.1 percent of GDP in 2005/06 (see Table III.1). Keeping in mind that the historical one-year-ahead absolute error in forecasting fiscal balances has been, on average, about 1 percent of GDP, one could conclude that the risk of breaking the golden rule during the last year of the cycle is well above zero. It is difficult to assess to what extent the present situation came about because the safety margin was not large enough or the underlying assumptions were not cautious enough to accommodate unexpected shocks and/or discretionary changes in fiscal policy. Nonetheless, it is noteworthy that the steady depletion of the safety margin for meeting the golden rule has been due to successive downward revisions to current balances (see Table III.1). For example, the 2003 PBR showed a substantial worsening in the cyclically-adjusted balances in both 2003/04 and 2004/05, reflecting lower-than-expected receipts from income and corporation taxes and additional spending on social benefits and defense.

9. **The recent experience suggests that output shocks may not always be the main source of uncertainty over the cycle.** It also illustrates that the key generator of uncertainty in one cycle may be different from that in another. While trend growth surprises may play an important role in one cycle, uncertainty about asset price changes—leading to revenue surprises in certain tax categories, such as corporation tax and income tax receipts—may be critical in another. Even within revenue categories, VAT receipts may underperform in one cycle, but corporation tax receipts may turn out weaker than expected in another. In addition, discretionary policy shocks can also play a role in eroding the safety margin for meeting the golden rule. Therefore, the experience with the golden rule so far motivates the questions addressed in the remaining sections.

Table III.1 Current Balance Revisions Since the Start of the Cycle

	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Cyclically-adjusted current balance (in percent of GDP)									
Budget 2000	1.8	1.3	1.3	1.0	0.7	0.7			
PBR 2000	1.9	1.5	1.4	1.1	0.6	0.7	0.7		
Budget 2001	1.9	2.1	1.4	1.1	0.6	0.7	0.7		
PBR 2001	2.0	2.3	1.0	0.3	0.3	0.5	0.7	0.7	
Budget 2002	2.1	1.8	1.0	0.5	0.6	0.7	0.6	0.7	
PBR 2002		1.7	0.7	0.2	0.3	0.6	0.5	0.6	0.7
Budget 2003		1.7	0.9	-0.5	0.2	0.5	0.4	0.4	0.6
PBR 2003			0.6	-0.6	-0.8	-0.1	-0.1	0.0	0.3
Budget 2004			0.6	-0.6	-1.0	-0.2	-0.2	0.0	0.3
PBR 2004					-1.0	-0.4	-0.4	0.1	0.3
Current balance (in percent of GDP)									
Budget 2000	1.9	1.5	1.6	1.2	0.8	0.7			
PBR 2000	2.1	1.7	1.6	1.2	0.8	0.7	0.7		
Budget 2001	2.1	2.4	1.7	1.4	0.8	0.8	0.8		
PBR 2001	2.3	2.6	1.0	0.3	0.4	0.6	0.7	0.7	
Budget 2002	2.3	2.3	1.1	0.3	0.6	0.8	0.6	0.7	
PBR 2002		2.2	0.8	-0.5	-0.4	0.2	0.4	0.6	0.7
Budget 2003		2.2	1.0	-1.1	-0.8	-0.1	0.2	0.4	0.6
PBR 2003			0.9	-1.1	-1.7	-0.7	-0.4	0.0	0.3
Budget 2004			0.9	-1.2	-1.9	-0.9	-0.4	0.0	0.3
PBR 2004					-1.9	-1.1	-0.6	0.0	0.3
Average current balance since 1999/2000 (in percent of GDP)									
Budget 2000	1.9	1.7	1.7	1.6	1.4	1.3			
PBR 2000	2.1	1.9	1.8	1.7	1.5	1.4	1.3		
Budget 2001	2.1	2.3	2.1	1.9	1.7	1.5	1.4		
PBR 2001	2.3	2.5	2.0	1.6	1.3	1.2	1.1	1.1	
Budget 2002	2.3	2.3	1.9	1.5	1.3	1.2	1.1	1.1	
PBR 2002		2.2	1.7	1.2	0.8	0.7	0.7	0.7	0.7
Budget 2003		2.2	1.8	1.1	0.7	0.6	0.5	0.5	0.5
PBR 2003			1.7	1.0	0.4	0.3	0.2	0.1	0.2
Budget 2003			1.7	1.0	0.4	0.2	0.1	0.1	0.1
PBR 2004					0.4	0.2	0.1	0.1	0.1

Source: HM Treasury

C. Methodology

10. **The performance of the golden rule is simulated under various realizations of output and asset-price fluctuations, as well as discretionary policy.** The simulation methodology builds on three steps.[2] The first step is to specify a simple reduced-form model of the current budget balance. The second step is to calibrate the parameters of the model in order to simulate it under stochastic shocks that broadly match the historical U.K. data on output and asset price fluctuations, as well as hypothetical discretionary policy shocks that affect the fiscal balances. The last step is to compute the cumulative current balance that corresponds to each generated output cycle (given the realizations of the asset price cycles and the assumptions about discretionary policy) and to examine the resulting distribution of cumulative current account balance for all simulated cycles.

Model specification

11. **The current budget balance is modeled as follows.**

- For each cycle *i*, total current revenues, r_{it}, are defined to be the sum of the following five components: (i) starting revenues, r_{io}; (ii) underlying (or structural) revenues, $r_{it}^{s}(\mu_t)$, which vary with trend growth, μ_t; (iii) cyclical revenues, $r_{it}^{c}(o_t)$, which depend on the output gap, o_t; (iv) asset-price related revenues $r_{it}^{h}(\eta_t)$ and $r_{it}^{e}(\delta_t)$, determined by whether the housing and equity markets are in a boom or a bust (η_t, δ_t = 1 or -1)[3]; and (v) discretionary change in revenues, r_{it}^{d}, which is assumed to be exogenous.

(1) $$r_{it} = r_{io} + r_{it}^{s}(\mu_t) + r_{it}^{c}(o_t) + r_{it}^{h}(\eta_t) + r_{it}^{e}(\delta_t) + r_{it}^{d}$$

- For each cycle *i*, total current expenditures, e_{it}, are equal to be the sum of the following four elements: (i) starting expenditures, e_{io}; (ii) underlying (or structural) expenditures, $e_{it}^{s}(\mu_t)$, which vary with trend growth, μ_t; (iii) cyclical expenditures,

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[2] All simulations were conducted using a collection of custom-built Java programs.

[3] Non-linearity is assumed to capture the buoyancy of certain taxes (e.g., capital gains tax, corporation tax, income tax on bonuses, etc.) during booms. This specification ignores any indirect impact of asset prices on fiscal revenue (via output) and considers the direct effect only.

$e_{it}^{c}(o_t)$, which depend on the output gap, o_t; and (iv) discretionary change in expenditures, e_{it}^{d}, which is assumed to be exogenous.

(2) $$e_{it} = e_{io} + e_{it}^{s}(\mu_t) + e_{it}^{c}(o_t) + e_{it}^{d}$$

- The corresponding current balance, b_{it}, is the difference between current revenues, r_{it}, and current expenditures, e_{it}. Using Equations (1) and (2), the total current balance can be decomposed into five parts, affected by the starting balance, trend growth, the output gap, asset (house and equity) prices, and discretionary policy (see Equation 3').

(3) $$b_{it} = r_{it} - e_{it} = (r_{io} - e_{io}) + \left(r_{it}^{s}(\mu_t) - e_{it}^{s}(\mu_t)\right) + \left(r_{it}^{c}(o_t) - e_{it}^{c}(o_t)\right) + \\ + \left(r_{it}^{h}(\eta_t) + r_{it}^{e}(\delta_t)\right) + \left(r_{it}^{d} - e_{it}^{d}\right)$$

(3') $$b_{it} = b_{it}^{s}(\mu_t) + b_{it}^{c}(o_t) + b_{it}^{h}(\eta_t) + b_{it}^{e}(\delta)_t + b_{it}^{d}$$

- For each cycle *i*, Equation (3') is normalized so that $b_{it}^{c}(0) = 0$ and $b_{it}^{s}(\bar{\mu}) = 0$,

  where $\bar{\mu}$ is the long-term average trend growth of the economy. All variables are expressed as percentages of GDP. The (semi) elasticity of the current balance with respect to output, ε, is taken to be 0.7, which is consistent with recent estimates.[4] The revenue effects from asset prices are assumed to be: i) zero in normal times, i.e., $b_{it}^{h}(0) = b_{it}^{e}(0) = 0$, and ii) symmetric and constant in booms and busts, i.e., $b_{it}^{h}(1) = -b_{it}^{h}(-1) = \theta$ and $b_{it}^{e}(1) = -b_{it}^{e}(-1) = \omega$. (Note that the parameters θ and ω need to be chosen.) Using these assumptions, Equation (3') takes the simplified form below that is used in the simulations.

[4] The choice of elasticity is based on the empirical analysis conducted by the HM Treasury (2003), which suggests that if GDP growth were one percentage point lower than assumed in a given year, the surplus on the capital budget would be lower by 0.5 percent of GDP in the first year and by a further 0.2 percent of GDP in the following year. While these coefficients are obtained by regressing spending and revenue ratios to GDP on estimates of contemporaneous and lagged output gaps, this paper assumes that the same elasticity is applicable to surprises in trend growth in the short run (over the cycle). In practice, discretionary policy is likely to respond to such surprises. However, this possibility is not explored below, and discretionary policy is taken to be exogenous.

(3'') $$b_{it} = b_{io} + \varepsilon(\mu_{it} - \bar{\mu}) + \varepsilon o_{it} + b_{it}^{a}(\eta_t, \delta_t) + b_{it}^{d}$$

- The baseline assumption about the starting value of the current balance is that b_{io} is zero for all *i*. By resetting the starting value, one could estimate the safety margin for a representative cycle. However, this assumption can be relaxed in order to examine the knock-off effects of discretionary policy shocks in one cycle on the following cycles by assuming that b_{io} is equal to the sum of all discretionary shocks from previous cycles ($b_{io} = \sum_{j=0}^{i-1} b_{jo}^{d}$).

Parameter calibration and cycle generation

12. **The next step is to choose stochastic processes and calibrate their parameters to generate series for output and asset price cycles that match the characteristics of historical data reasonably well**. The ultimate objective is to feed Equation (3'') with simulated output shocks (μ_t, o_t) and asset price shocks (η_t and δ_t) generated by the calibrated stochastic processes.

Output cycles

13. **The starting point is to establish the characteristics of the U.K. business cycle that need to be matched by the simulated data.** Unlike the NBER in the U.S., there is no official arbiter of the timing of the U.K. cycle. However, previous studies have adopted various techniques to analyze the U.K. business cycle (Artis (2002), Krolzig and Toro (2001), Ravn (1997), Birchenhall, Osborn, and Sensier (2000)). Starting with a classical definition of the cycle, this paper uses a modified version of the Bry-Boschan (BB) algorithm (as in Harding and Pagan (1999a)) to find peaks and troughs in the U.K. real output series from 1955Q1 to 2004Q2. The resulting turning points match quite closely with those reported in Artis (2002). The average duration and amplitude of recessions and expansions are calculated to provide a reference point for the simulated data.

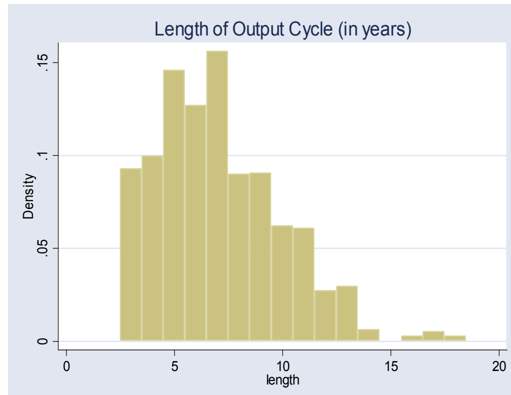
14. **As illustrated in Harding and Pagan (1999b), a simple model of output growth captures the characteristics of the U.K. cycle quite well**. In particular, quarterly output growth is assumed to be a random walk with drift, i.e., $\Delta y_t = \mu + \xi_t$, where μ is the drift parameter (= 0.062) and ξ_t is the error term that is normal and independently distributed with a standard deviation σ (=0.009). The above stochastic process and parameter values are used to generate 50000 observations of quarterly real output. Note that by construction, the first and second moments of the actual and simulated series coincide. Thus

Characteristics of Actual and Simulated Output Cycles

	Duration (in months)		Amplitude (in percent)	
	Actual	Simulated	Actual	Simulated
Peak to trough	8	15	0.04	0.07
Trough to peak	21	19	0.19	0.15
Peak to peak	34	34	-	
Trough to trough	30	34	-	

the simulated data are analyzed for peaks and troughs and compared to the actual data on the basis of cycle duration and amplitude. The results show that the simulated cycles resemble the actual ones (see table).

15. **The simulated data are then used to derive cycles based on crossing points between trend and actual output, in the spirit of the HM Treasury definition**. The precise methodology used by the Treasury to calculate trend growth and the output gap cannot be applied, since no measures of economic slack are available to determine the on-trend points in the cycle. As an alternative, the simulated series are detrended using a Hodrick-Prescott filter. The data frequency is changed from quarterly to yearly. The output cycles used in the simulations are obtained by identifying the crossing points between trend and actual output.[5] In each cycle, actual output crosses trend output three times. The average length of resulting cycles (n = 1750) is 7 years, with the shortest and longest cycle lasting 2 and 18 years, respectively (see chart).



Asset price cycles

16. **House price and equity price cycles are generated in a similar way to output cycles**. In particular, quarterly data on real house and stock prices are used to estimate the parameters of the stochastic processes. (Admittedly, the specification of real house prices as a random walk with drift does not fit the data well, as a lot of serial correlation is left in the errors.) The characteristics of actual and simulated asset price cycles are shown above.

Characteristics of Actual and Simulated House and Equity Price Cycles

	Duration (in months)		Amplitude (in percent)	
House price	Actual	Simulated	Actual	Simulated
Peak to trough	11.2	8.5	0.32	0.43
Trough to peak	12.6	10.5	0.20	0.35
Peak to peak	23.4	19.0	-	-
Trough to trough	24.8	19.5	-	-
Equity price				
Peak to trough	11.2	9.7	0.45	0.35
Trough to peak	12.6	9.8	0.39	0.36
Peak to peak	22.6	19.4	-	-
Trough to trough	22.3	19.5	-	-

17. **Boom and bust episodes are identified using the simulated asset price series**. In particular, the housing (stock) market is defined to be in a boom (bust) in a given year if the house (equity) prices are significantly above their trend values in that year, i.e., in the 90th

[5] This is different from the classical definition of cycles discussed above, which is based on turning points and uses the level of output only.

(10^{th}) percentile of the distribution of deviations from the trend line.[6] During the boom and bust periods, revenues are assumed to differ from their normal times due to the direct effect of asset prices on certain tax categories, such as stamp duty, capital gains tax, corporation and income taxes, etc.[7] The magnitude of the house price and equity price effects, θ and ω, is assumed to be in the range of 0.8 to 1.6 percentage points of GDP in each boom year, which is broadly consistent with existing estimates in the literature (see Eschenbach and SchU.K.necht (2002, 2004)).

Discretionary policy

18. **Discretionary shocks are assumed to be exogenous and stochastic**. The exogeneity assumption is made for the sake of simplicity and tractability. (A possible extension of the model is to make discretionary policy endogenous, although this would involve the difficult task of calibrating a fiscal response function.) The distribution of discretionary policy shocks is taken to be uniform and symmetric at zero. In particular, $b_{it}^{d} \sim U[-d,d]$, where *d* is the upper bound of the distribution. In the simulation, *d* takes on several values (*d* = 0.01, 0.02). Note that the symmetry assumption is consistent with the "integral" definition of the U.K.'s golden rule, which allows fiscal easing during one part of the cycle as long as it is compensated by fiscal tightening during another.

Cumulative balance computation

19. **Using the simulated series for output and asset price shocks, the cumulative current balance is computed for each simulated economic cycle.** For instance, the cumulative balance for a cycle *i*, which lasts T_i years, is calculated as the sum of the current balances throughout the cycle. These current balances are derived using Equation (3''), given the realizations of output and asset price shocks (μ_t, o_t, η_t and δ_t) for this particular cycle.

(4)
$$c_i = \sum_{t=1}^{T_i} b_{it}$$

Since each simulated cycle gives rise to a cumulative balance c_i, the total number of realizations of the golden rule is as large as the number of simulated output cycles.

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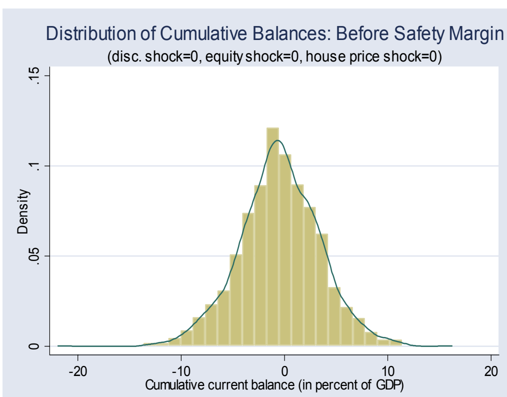
[6] About 17 percent of the simulated output cycles have no such periods; 40 percent have a stock market boom (or bust); and 40 percent have a housing market boom (or bust).

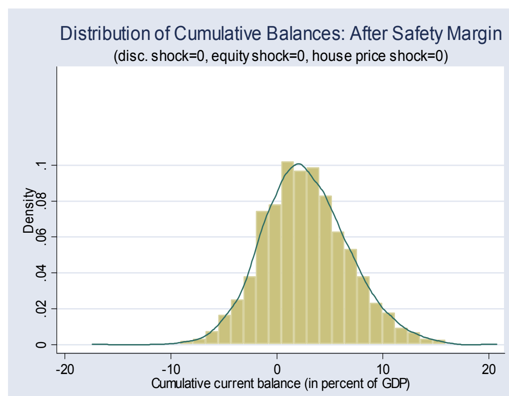
[7] For example, the equity market boom of the late 1990s was associated with a substantial rise in company profits and individual bonuses, which boosted corporation and income tax receipts.

20. **The distribution of cumulative balance outturns can be used to examine in what proportion of the cases the golden rule is broken and by how much**. Given this information, one can compute how large the safety margin, *s*, should be so that only a given proportion *p* of the overall distribution corresponds to negative values of the cumulative balance. This (ex-ante) safety margin *s* would correspond to a (1-*p*) probability of meeting the golden rule. In addition, one could examine how the size of the margin varies with the nature and the magnitude of the underlying shocks stemming from output and asset-price fluctuations and discretionary policy.[8]

D. Results and Discussion

21. **The impact of output uncertainty on the simulated distribution of cumulative budget balances is significant even in the absence of other shocks**. In 25 percent of the cases, the cumulative current deficit exceeds 2.9 percent of GDP (see chart). To ensure that the golden rule is met with a 75 percent probability, the corresponding annual safety margin needs to be about 0.45 percent of GDP. If this buffer is maintained in all simulated cycles, only 25 percent of the overall distribution of cumulative balances will be negative (see chart).





22. **The effect of asset price uncertainty on the shape and dispersion of the cumulative distribution relative to the previous case is quite striking**. If equity and house price shocks are added to the simulations, the distribution of cumulative balances becomes more dispersed and the associated margin of safety rises compared to the case of output shocks only (see chart). This happens because even though an asset price boom (or bust)

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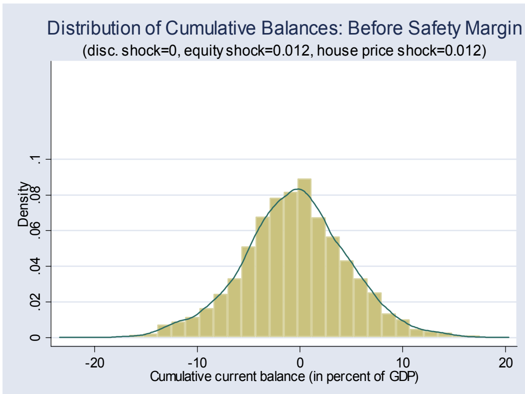
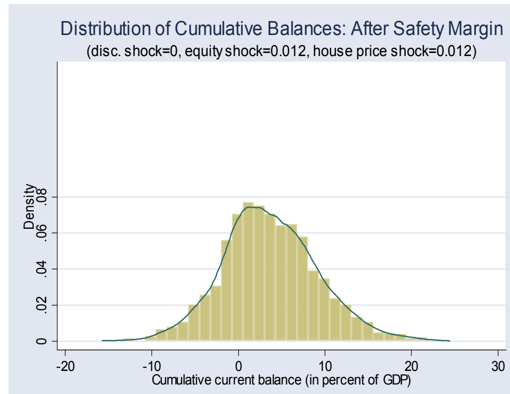
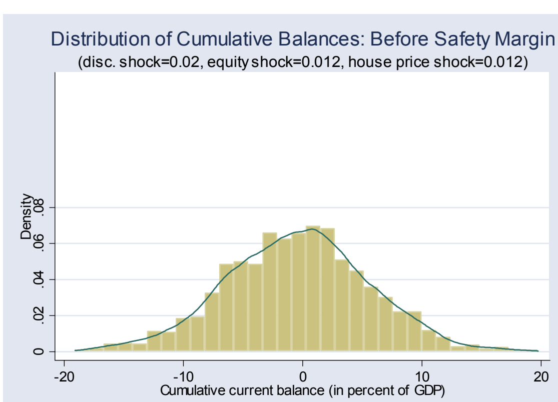
[8] The above setup assumes that the safety margin is set at the beginning of the cycle and is not adjusted as the cycle unfolds.

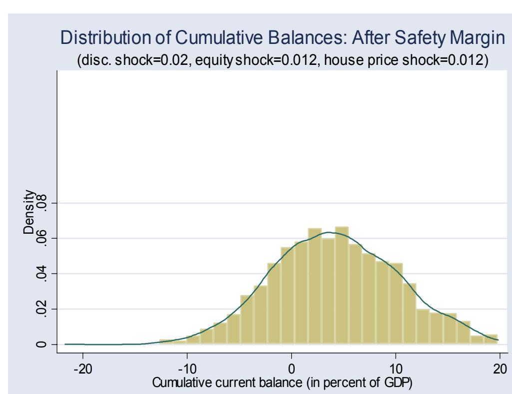




is a low probability event, the size of the shock (when it occurs) is large. Now the annual safety margin associated with a 75 percent chance of meeting the golden rule is estimated to be about 0.6 percent of GDP (see chart). However, the marginal impact of asset prices on the safety margin depends heavily on how large the revenue effects of equity and house prices are assumed to be. The result presented above is based on the premise that revenues are higher by about 1.2 percent of GDP in each boom year and lower by the same amount in each bust year. If the size of the revenue effect is assumed to be 1.6 percent per year, the distribution of cumulative balances becomes even more dispersed and the safety margin increases to 0.7 percent of GDP. But if the revenue effect is taken to be 0.8 percent per year, the corresponding safety margin falls to 0.5 percent of GDP.

23. **Discretionary shocks also have an impact on the distribution of cumulative balances.** Adding discretionary shocks to the preceding simulations could increase the safety margin further. For example, assuming that the starting current balance is zero for each cycle and the width of the discretionary shock distribution d is 0.02 (see para. 19), the distribution of cumulative balances acquires more weight in its tails compared to the previous case of





output and asset price shocks. In particular, the safety margin corresponding to a 75 percent chance of meeting the golden rule rises further to 0.7 percent of GDP.[9] However, the marginal effect of discretionary shocks on the safety margin declines as the narrowing width of the underlying distribution, *d*, decreases the size of the discretionary shocks.

24. **The relationship between the size of the safety margin and the probability of meeting the golden rule is summarized below for various sources of uncertainty** (see Table III.2). The overall margin of safety rises sharply as the desired probability of adhering to the rule increases. For instance, it almost doubles if the probability goes up from 75 to 90 percent and doubles again if the probability rises further to 99 percent. It is also worth noting that for a given probability of meeting the golden rule and parameter specification, the overall safety margin is larger than the safety margin due to any particular source of uncertainty. Nonetheless, it is smaller than the sum of the safety margins from each source of uncertainty, as various types of shocks partly offset each other. The results also illustrate how the overall margin evolves depending on the assumed magnitude of the asset price effect (see *Specifications 1-3*). For example, the desired buffer rises from about 1¼ to 1¾ percent of GDP as the assumption about the revenue effect of an asset price boom changes from 0.8 to 1.6 percentage points of GDP.

25. **The above analysis is subject to a number of limitations**. *First*, the model specification is very simple and assumes that all types of shocks are uncorrelated. In practice, however, asset price shocks are likely to be positively correlated with output, raising the size of the safety margin. In contrast, if policy is allowed to respond to output and asset price shocks, the discretionary shocks are likely to be negatively correlated with output and asset price shocks, decreasing the desired magnitude of the fiscal buffer. *Second*, the true parameters of the model may be different from the calibrated parameters used in the simulations. For instance, the volatility of output may have declined permanently, reducing the required magnitude for a current surplus buffer. In spite of these limitations, however, the results are useful in highlighting the implications of implementing an asymmetric fiscal rule and illustrating the relationship between the safety margin and the uncertainty stemming from various sources.

26. **Going back to the three questions posed at the beginning of the paper, one could draw on the empirical findings to answer them as follows**.

- *What is the relationship between the size of the safety margin and the risk of breaching the golden rule?* The findings suggest that there is a strong inverse, nonlinear

[9] If the assumption of zero starting current balance for each cycle is relaxed to allow for discretionary shocks to carry over (see para. 13, bullet 5), the probability that the golden rule will be broken is high even if the above safety margin is implemented. This occurs because if the starting balance for a given cycle is negative (reflecting historical discretionary shocks), the entire distribution of the safety margin for that cycle is worsened.

relationship between the size of the safety margin and the risk of breaking the rule. The baseline results show that the (ex-ante) safety margin required to meet the golden rule with a 75 percent chance during a representative cycle is around 0.6 percent of GDP (see Table III.2). However, increasing the probability to 99 percent requires a safety margin of 2.3 percent of GDP. Making the plausible assumption that maintaining a very high safety margin involves a substantial cost to society, one could infer that policy-markers are likely to choose a safety margin that is associated with some positive probability of breaching the golden rule.

- *How does the size of the safety margin depend on the characteristics of the likely shocks that hit the economy?* The simulation results indicate that output shocks are not the sole determinant of the safety margin. Providing against asset price shocks also requires a substantial safety margin. Its size depends on the underlying assumptions about the magnitude of the direct effect of asset prices on fiscal revenues. At the beginning of each cycle, uncertainty about discretionary policy shocks can raise the level of the safety margin as well.

- *What are the policy implications of subscribing to the above probabilistic approach to the golden rule?* The estimated relationship between the size of the safety margin and the risk of breaching the rule suggests that providing for *all* uncertainty can be very costly. Therefore, it is important that policy makers be explicit about the size of the safety margin that is incorporated in the fiscal projections *and* the associated probability of breaking the golden rule. This could be achieved by using central (rather than cautious) assumptions and stating explicitly how large the overall safety margin is. In addition, the ex-ante and ex-post probability of breaching the golden rule could be communicated by using a fan chart of the current balance, as well as the associated cumulative balance. (These proposals are also put forward in Emmerson, Frayne, and Love (2004).)

Table III.2. Sources of Uncertainty and the Annual Safety Margin

Probability of Meeting the Golden Rule	75 percent	90 percent	95 percent	99 percent
Specification 1: d = 0.01, θ = ω = 0.012				
Overall safety margin	**0.60**	**1.17**	**1.50**	**2.29**
Output gap uncertainty only	0.31	0.55	0.64	0.98
Trend uncertainty only	0.30	0.62	0.82	1.29
Equity price uncertainty only	0.17	0.45	0.72	1.20
House price uncertainty only	0.17	0.45	0.67	1.20
Discretionary policy uncertainty only	0.17	0.33	0.44	0.63
Output trend and gap uncertainty	0.45	0.83	1.06	1.71
Output and asset prices uncertainty	0.59	1.10	1.45	2.22
Specification 2: d = 0.01, θ = ω = 0.008				
Overall safety margin	**0.54**	**1.04**	**1.32**	**2.02**
Output gap uncertainty only	0.31	0.55	0.64	0.98
Trend uncertainty only	0.30	0.62	0.82	1.29
Equity price uncertainty only	0.11	0.30	0.48	0.80
House price uncertainty only	0.11	0.30	0.44	0.80
Discretionary policy uncertainty only	0.17	0.33	0.44	0.63
Output trend and gap uncertainty	0.45	0.83	1.06	1.71
Output and asset prices uncertainty	0.52	0.97	1.25	1.91
Specification 2: d = 0.01, θ = ω = 0.016				
Overall safety margin	**0.70**	**1.31**	**1.75**	**2.69**
Output gap uncertainty only	0.31	0.55	0.64	0.98
Trend uncertainty only	0.30	0.62	0.82	1.29
Equity price uncertainty only	0.23	0.60	0.96	1.60
House price uncertainty only	0.23	0.60	0.89	1.60
Discretionary policy uncertainty only	0.17	0.33	0.44	0.63
Output trend and gap uncertainty	0.45	0.83	1.06	1.71
Output and asset prices uncertainty	0.67	1.22	1.65	2.61
Specification 2: d = 0.02, θ = ω = 0.012				
Overall safety margin	**0.70**	**1.31**	**1.69**	**2.60**
Output gap uncertainty only	0.31	0.55	0.64	0.98
Trend uncertainty only	0.30	0.62	0.82	1.29
Equity price uncertainty only	0.17	0.45	0.72	1.20
House price uncertainty only	0.17	0.45	0.67	1.20
Discretionary policy uncertainty only	0.32	0.65	0.85	1.27
Output trend and gap uncertainty	0.45	0.83	1.06	1.71
Output and asset prices uncertainty	0.59	1.10	1.45	2.22

E. Conclusions

27. **The discussion in this paper leads to the following conclusions**. *First*, given that the golden rule is asymmetric (current balance or better over the cycle), the government would need to target a small current surplus *ex ante* if it wants the probability of meeting the rule to be higher than 50 percent *ex post*. *Second*, the higher the desired probability of meeting the rule, the higher the safety margin. For example, the results suggests that the average current surplus needed to meet the golden rule with a 75 percent chance during a representative cycle is about ½ percent of GDP. Increasing this probability to 99 percent requires a significantly higher current surplus (2¼ percent of GDP). In other words, attempting to drive the risk of breaching the rule to close to zero could be very costly from macroeconomic and intergenerational perspectives. Thus, it is important to be explicit about both the desired probability of meeting the rule and the associated target for the average current surplus. *Third*, the analysis illustrates that the safety margin depends not only on output shocks but also on asset price and discretionary policy shocks. In particular, the overall safety margin is larger than the safety margin due to any particular source of uncertainty, although it is smaller than the sum of the safety margins due to specific sources, as different types of shocks partly offset each other.

Data Description and Sources

This appendix describes the data used in the simulations.

Output: Quarterly real GDP series from 1960Q1 to 2004Q2. *Source*: ONS.

House prices: Quarterly real house prices. Mix-adjusted house price index from 1968Q2 to 2004Q2, deflated by GDP deflator. *Source*: ODPM.

Equity prices: Quarterly real equity prices. Price index (FTSE All-Shares) from 1962Q2 to 2004Q2, deflated by GDP deflator. *Sources*: Bloomberg, ONS.

References

Artis, M. (2002), "Dating the Business Cycle in Britain," CGBCR Discussion Paper Series, available at http://www.ses.man.ac.U.K./cgbcr/discussi.htm

Balls, E., and G. O'Donnell (2002), *Reforming Britain's Economic and Financial Policy: Towards Greater Economic Stability*, London.

Birchenhall, C., Osborn, D. and M. Sensier (2000), "Predicting U.K. Business Cycle Regimes," Centre for Growth and Business Cycle Research, available at http://www.ses.man.ac.U.K./cgbcr/

Emmerson, C., C. Frayne, and S. Love (2004), "Updating the U.K.'s Code for Fiscal Stability," IFS Working Paper No. 04/29.

Eschenbach, F. and L. SchU.K.necht (2002), "Asset Prices and Fiscal Balances," ECB Working Paper No. 141.

Eschenbach, F. and L. SchU.K.necht (2004), "Budgetary Risks from Real Estate and Stock Markets," *Economic Policy*, July 2004, pp. 313-346.

Harding, D. and A. Pagan (1999), "Knowing the Cycle," Melbourne Institute Working Paper No. 12/99.

Harding, D. and A. Pagan (1999), "Dissecting the Cycle," Melbourne Institute Working Paper No. 13/99.

HM Treasury (1997), "Fiscal Policy: Lessons from the Last Economic Cycle," available at http://www.hm-treasury.gov.U.K./mediastore/otherfiles/lessons.pdf.

HM Treasury (2003), "End of Year Fiscal Report," available at http://www.hm-treasury.gov.U.K./media/324/70/end_of_year_352[1].pdf

Kell, M. (2001), "Assessment of Fiscal Rules in the United Kingdom," IMF Working Paper No. 01/91.

Krolzig, H. and J. Toro (2001), "Classical and Modern Business Cycle Measurement: The European Case," Institute of Economics and Statistics Oxford Discussion Paper, available at http://ideas.repec.org/p/cea/doctra/e2002_20.html

Ravn, M. (1997), "Permanent and Transitory Shocks, and the U.K. Business Cycle," *Journal of Applied Econometrics*, Vol. 12, pp. 27-48.

IV. PROPERTY TAXES AND THE HOUSING MARKET[1]

A. Introduction

1. **Fluctuations in house prices, and their impact on activity, have been a central feature of the U.K. business cycle.** Over the past 30 years, real house prices have not only grown stronger than in the euro area, but have also been more volatile and associated with overall macroeconomic fluctuations. Housing market peculiarities were underscored by HM Treasury's EMU studies, which identified house price fluctuation as a key reason for cyclical divergences, as well as differences in the transmission of monetary policy impulses, setting the United Kingdom apart from the euro area economies.[2] The macroeconomic implications of sharp movements in house prices are analyzed in Chapter II of this paper[3] where the effectiveness of policy in mitigating adverse effects on output and inflation is discussed. Because of the importance of reducing volatility in the U.K. housing market, a number of researchers have studied the role of microeconomic and market structures, and the potential for fiscal instruments to improve market outcomes.

2. **Flexible-rate mortgage financing and supply constraints have been identified as the major reasons for the volatility in house prices.** Two recent reports, commissioned by HM Treasury, concluded that mortgage financing and inelastic housing supply explained much of the distinctiveness in the U.K. housing market, and explored ways to reduce volatility in house prices. The Miles Report looked into prospects of increasing the share of fixed-rate mortgages in housing finance, while the Barker Report studied the impact of supply constraints.[4] The Barker Report also reflected on possible ways for fiscal policy to help reduce volatility in the housing market, including through reform of property taxation (the council tax).

3. **In the United Kingdom, the council tax on housing is determined by local financing needs.** The council tax[5] is local authorities' main discretionary revenue instrument, covering about 25 percent of local expenditures. It was introduced in 1993 as a

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[1] Prepared by Werner Schule.

[2] See HM Treasury (2003), Housing, consumption and EMU, EMU study.

[3] *How Should Policymakers Respond to a Decline in House Prices*?

[4] D. Miles (2004), The U.K. Mortgage Market: Taking a Longer-Term View, HM Treasury; and K. Barker (2004), Review of Housing Supply, Final Report, HM Treasury.

[5] Of the five current property (housing) taxes in the United Kingdom – capital gains tax, inheritance tax, VAT on repairs, stamp duty and council tax - stamp duty and council tax share the property that the effective tax rate tends to fall with rising house prices. For an overview of housing taxation in the United Kingdom see Institute for Fiscal Studies (2004).

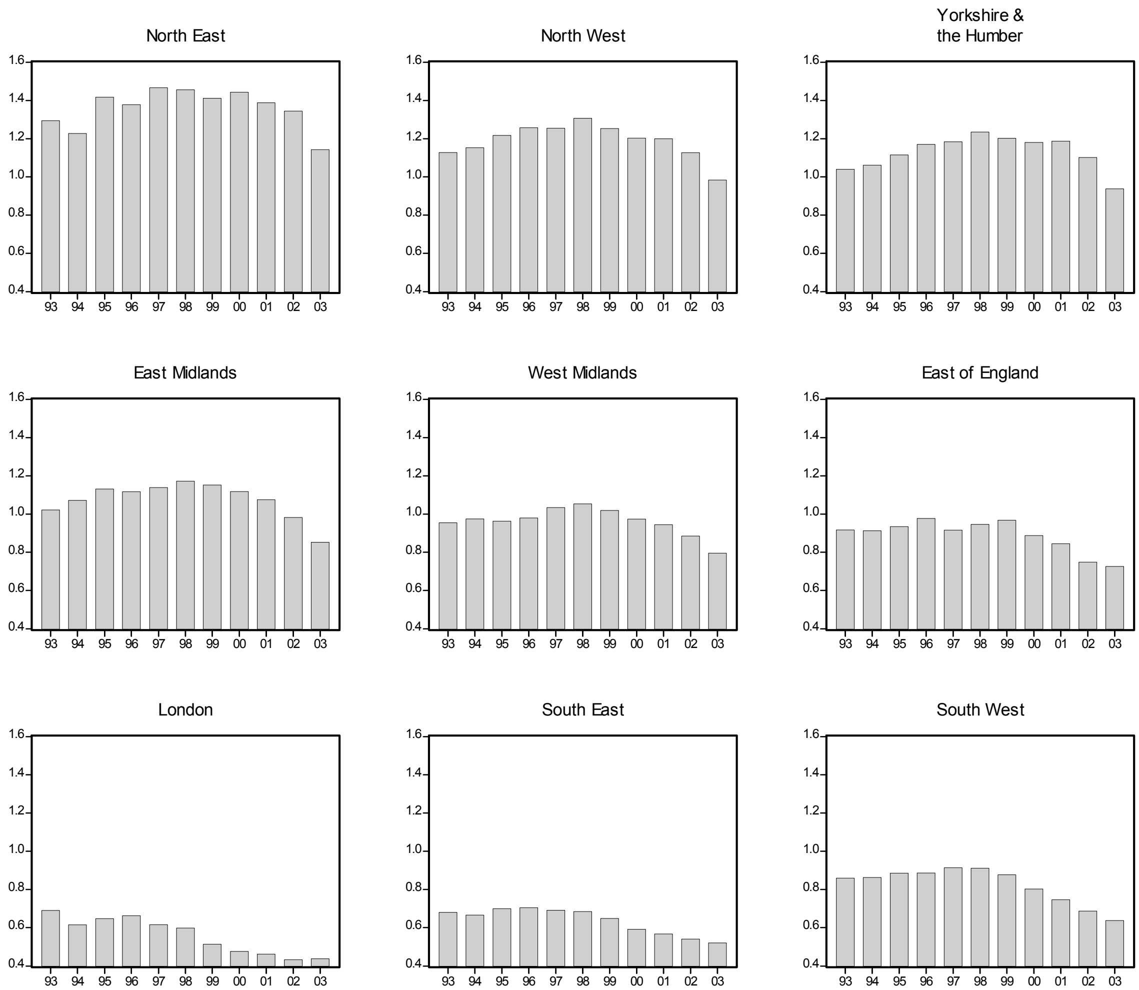
replacement for the unpopular community charge ("poll tax"). It is a tax on housing, paid by owners and renters, and based on the assessed value of a property, currently as of April 1991. Properties are divided into eight tax-liability bands. As higher income households tend to own houses in the upper brackets, these households pay on average higher property taxes in absolute terms. But the implicit tax rate, the ratio of taxes paid to property values, tends to fall when values increase. This puts in effect a disproportionately larger burden on lower incomes (income regressiveness). Similarly, communities with low average house values are burdened with a higher effective council tax rate, because local authorities' spending varies less than house prices across communities (regional regressiveness). This tax has drawn heavy criticism for a number of reasons, most prominently the two noted, its regressiveness across households and regions.[6]

4. **A redesigned council tax could address these shortcomings, and, as the Barker report argued, strengthen fiscal automatic stabilizers as well.** A redesigned tax could withdraw a higher proportion of household income when property values increase because it could take advantage of the fact that house prices typically fluctuate considerably more than before-tax income. With annual property assessments (or indexation of housing values between multi-annual assessments) the tax base would move in line with house prices and therefore in excess of household income. Combined with a fixed tax rate, the council tax could play a countercyclical role.[7]

[6] Cameron and Muellbauer (2000) list 12 reasons for reforming the council tax.

[7] This was also suggested in "Fiscal Stabilisation and EMU," EMU Study (2003), HM Treasury.

Figure IV.1. Effective Council Tax Rates by English Regions



The effective council tax rate is defined as the ratio of average council taxes for 2 adults in band D, before transitional relief and benefits, to simple average house prices of all dwellings.

Source: ODPM, Local Government Finance Statistics.

5. **Effective council tax rates are negatively correlated with house price inflation across regions in England.** Since 1997, house prices have risen more sharply in the United Kingdom on average than local council tax revenues, mainly because property values are not assessed annually. As a result, the effective council tax rate has fallen over time. The strongly negative relation between the level of effective council tax rates (defined as the ratio of average council taxes per dwelling to the respective average house prices) and the average rate of house price increases by English regions, suggests that the council tax might have contributed to house price inflation (Figure IV.2).

Figure IV.2. Level in Implicit Council Tax rate Against Increase in Real House Prices (1998 to 2003)

6. **The focus of this paper is on an empirical evaluation of the impact of the council tax on medium-term house price volatility through its impact on the user cost of housing.** Although important dimensions of the broader issue of tax reform, neither the council tax's short-term macroeconomic and distributional impact nor its role as a reliable source of local government income are explicitly examined. The empirical analysis finds evidence that declining effective council tax rates have had a positive impact on house price volatility over time and across regions. However, the magnitude of these effects was found to be small relative to other factors influencing house prices.

7. **The remainder of this paper is organized as follows.** In Section B, the theoretical model of house prices is presented highlighting the role that the council tax can play in house price volatility through its effect on the user cost of housing. The panel estimates of the model are presented in Section C along with some robustness checks. Some conclusion are offered in Section D.

B. Property Taxation Affects House Price Volatility through User Costs of Housing

8. **A house price equation is obtained by inverting the demand function for housing services.** Housing demand is assumed to increase with the number of households (or population) and the average household income, and to fall with rising real user costs of housing services. Other factors, such as changes in preferences for housing services relative to other consumption items, may also play a role.[8]

$$H = f\left\{y, pop, uch, Z\right\} \tag{1}$$

Equation (1) describes housing demand (*H)* as a function of demographic factors (*pop)*, average real household income *y*, user costs of housing (*uch)*, and (*Z)* representing any other factor that might shift the demand-for-housing curve. The slope of the housing demand curve is determined by the elasticity of demand for housing services with respect to the user costs of housing. With a high elasticity, a relatively small change in user cost is sufficient to minimize the impact on prices of an exogenous shift in demand.

The user costs of housing are proportional to house prices (*P)*. They increase with the (tax adjusted) nominal mortgage rate (*r*), the rate of depreciation including maintenance costs (δ), and the property tax rate (τ), and fall with expected capital gains on the housing stock (π^e), or expected house price inflation.

$$uch = \left[r + \tau + \delta - \pi^e\right]P \tag{2}$$

Using (2) the demand equation (1) can be inverted to obtain an equation for house prices.

$$P = g\left\{H, pop, y, \left(r + \delta + \tau - \pi^e\right), Z\right\} \tag{3}$$

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[8] A similar model was developed by J.R. Kearl (1979), and modified in many ways by Poterba (1984,1991), Muellbauer and Murphy (1997), Meen and Andrew (1998) and many others. This presentation draws heavily on Van den Noord (2003).

9. **In the short run, the supply of housing is either fixed or inelastic with respect to price and demand factors.** Housing supply will increase as long as prices of existing houses remain above construction costs (*C*). Space limitations, zoning and other restrictions may however prevent equilibrium house prices from settling in the neighborhood of construction costs. Consequently, the supply elasticity (η) is very small (the slope of the supply curve very steep) in the short run.

The supply curve is:

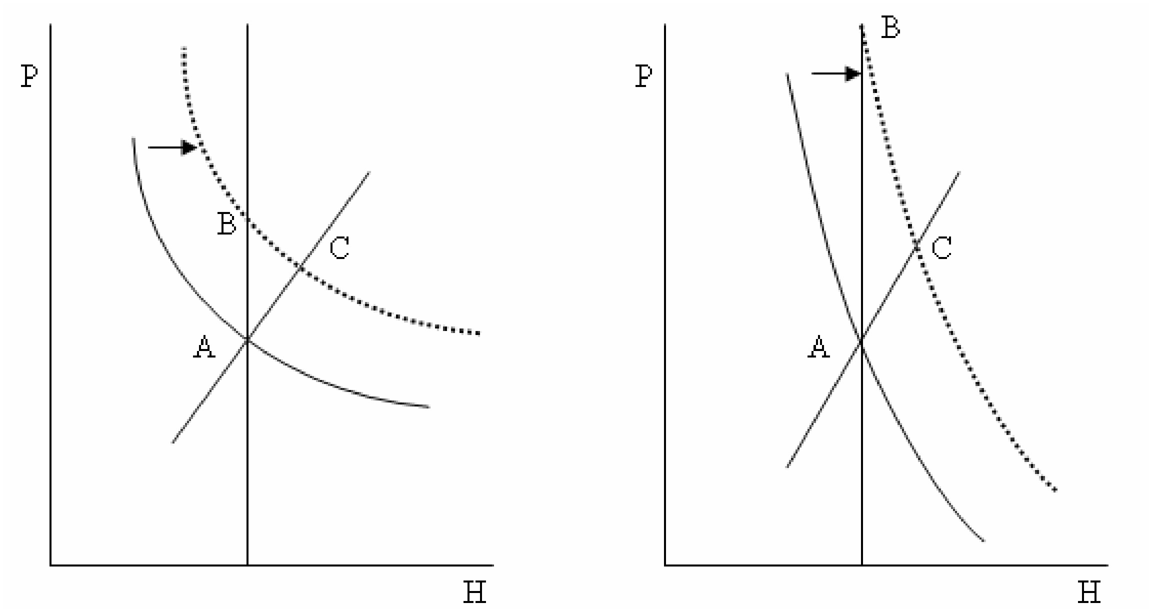
$$\text{(4)} \quad \Delta H = \eta \left(\frac{P}{C} \right) - \delta H_{-1}$$

10. **In the long run, however, supply constraints, such as planning restrictions, are often eased.** Planning is necessary to preserve the environment, avoid excessive congestion and limit other unwelcome by-products of building activities. However, the weights on political preferences might shift. When excess demand persists, economic considerations are likely to gain weight at the expense of other concerns. Therefore the elasticity of housing supply with respect to prices (η) is likely to be larger in the long run. But even with a time-invariant price elasticity, the supply curve becomes more positively sloped when the existing housing stock gets replaced or upgraded. Depending on the depreciation rate (δ), the long-run elasticity (η/δ) is larger even at an unchanged but non-zero price elasticity (η).

11. **Short-run supply constraints lead to overshooting in house prices.** The model is closed by assuming equality between demand and supply. An increase in demand will initially cause prices to rise above its new long-run equilibrium, and subsequently fall back (Box IV.1). The extent of price overshooting depends on a number of factors, which are typically identified to play a role in U.K. house price fluctuations, most prominently supply constraints and flexible-rate mortgage financing, but taxes also play a role. The simple model serves as a useful analytical tool to help understanding the possible influence of property taxes on house price fluctuations in the United Kingdom.

12. **Mortgage rates tend to rise in cyclical upswings, and therefore mitigate price fluctuations.** In the United Kingdom, largely due to the predominance of variable-rate mortgages, current and expected monetary policy moves are quickly transmitted to mortgage interest payments. Following a forward-looking inflation targeting rule, the Bank of England hikes policy rates when inflation would otherwise be expected to rise above target. As inflationary pressures build up when demand is growing faster than supply and the output gap is closing, policy interest rates will often move counter-cyclically with income. Changes in policy rates are quickly transmitted into mortgage rates, dampening housing demand relative to income, and therefore mitigating price fluctuations.

Box IV.1. Housing Market Mechanics



In a linearized version of the model the slope of the demand curve in the H-P plane, holding all else constant, is simply given by $-1/\left(r+\tau+\delta-\pi^{e}\right)$. An increase in income, population or other factors will shift the demand curve to the right, and lead to a stronger price increase when the mortgage, property tax or depreciation rates are low and expected house price increases are high (right picture). In the short run, when supply is predetermined, an increase in demand, shifting the demand curve out, will cause prices to increase from the original equilibrium in point A to a new temporary equilibrium point B. In the long run, supply reacts (the supply curve become positively sloped) and house prices fall back to point C. The degree of house price overshooting is inversely related to real user costs of housing, with the effective council tax rate as one component.

While the overshooting effect can be large in theory, an illustrative calculation based on average data values shows that the council tax's contribution is more likely to be small in practice. Over the 1970 to 2003 period, the average value of (uch-τ) has been 2.7 percent, while the spread between the highest and lowest effective council tax rates was 1.5 percentage points. Given these numbers, and assuming a unitary income elasticity of housing demand H, a two standard deviation shock to real income (equivalent to 10 percent) causes house prices to overshoot by 0.1 percent at the high effective tax rate and by 0.2 percent at the low rate. However, the exact magnitudes of these effects in practice is an empirical question that is addressed in the next section.

13. **Taxes can both exacerbate or dampen house price volatility.** For example, the deductibility of mortgage payments from income taxes reduces the effectiveness of a given change in interest rates. Likewise, stamp duties and the U.K. type of property taxes can undermine endogenous stabilization of house prices through their impact on the user cost of housing variable,[9] if constructed as they currently are in the United Kingdom, or they can reinforce automatic stabilizers if redesigned to serve this purpose.

C. Estimating the Effect of Council Taxes on House Prices

14. **The price equation is estimated using regional data from 1969 to 2003.** Efficient use was made of the available information by pooling data over time and across sections. The cross sectional dimension is given by the nine regions in England:[10] North East, North West, Yorkshire and the Humber, East Midlands, West Midlands, East of England, London, South East and South West. Changes in real house prices (in each region) are linked to changes over time in regional demographics, regional real disposable household income, and regional real user costs of housing.

Real house prices

(3) $$\Delta \ln(P_{i,t}^{real}) = c + \beta(X_{it}) + \delta_i + \varepsilon_{it} \quad ,$$

where

$$X_{it} = \left[\Delta \ln(H_{it}), \Delta \ln(Y_{it}), \Delta \frac{uch_{it}}{P_{i,t}} \right];$$

$P_{i,t}^{real}$: real house prices by region ($P_{i,t}/ RPI_t$);
RPI_t : retail price index ;
H_{it} : number of households in each region (or population);
Y_{it} : real disposable income (mortgage holders), deflator RPI_t;
uch_{it} : user costs of housing services;
δi : fixed or random cross-section effects;
ε_{it} : error terms.

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[9] Beyond the user cost of housing channel, housing taxation affects disposable income, the allocation of savings and labor mobility.

[10] Council tax revenues by English regions are available online from 1993/4 to 2004/5 only. Regional data on prices, income, and demographics are available over a longer time range (at least 1970 to 2003), but other potentially relevant factors are available only for shorter time periods (housing stocks by regions), or difficult to find (rents, regional construction costs). The community tax regime in England differs from those in Scotland and Wales, while Northern Ireland continues to tax properties according to the old national tax regime. Therefore the discussion here focuses on the more homogenous English regions.

User cost of housing

(4) $$uch_{it} = \left\{ r_t + m_{it} + \vartheta + ct_{it} - \pi^e_{it} \right\} P_{i,t}$$

r_t : mortgage interest rate (Nationwide);[11]
m_{it} : maintenance cost, calibrated [0.025];[12]
ϑ : depreciation rate, calibrated [0.015];[12]
ct_{it} : effective council tax rate, calculated as tax revenues divided by house values;[13]
π^e_{it} : expected capital gains (HP trend of nominal house price inflation)

Inflation expectations

15. **The user costs are strongly influenced by expected house price inflation in times of high price increases, but expectations are not observable and need to be estimated.** While rational (or model consistent) expectations are theoretically satisfactory, it is difficult to constitute them in a partial equilibrium context. Also, households often buy a property to live in it, and enjoy non-pecuniary advantages of ownership, which may not be entirely reflected in rational equilibrium models. Applying the Hodrick-Prescott filter−which is essentially a centered moving average−implies a combination forward- and backward-looking behavior. It is assumed here that this representation fits households expectation well. The HP filter however suffers from an 'end-point problem', which limits its usefulness at the sample period end. It has therefore been corrected in the following way: (i) as from 2005, annual real house price increases are gradually returning to their average pace over the past 35 years (0.5 adjustment speed); (ii) a two percent CPI inflation rate is added; (iii) the resulting series is HP filtered over the period 1970–2008.[14] The following Figure IV.3 shows annual percentage house price increases in London and its adjusted and non-adjusted HP

[11] Alternatively the tax adjusted mortgage rate $r_t(1-t_{i,t})$ could be applied, using time varying tax rules, and marginal income tax rates across regions and time.

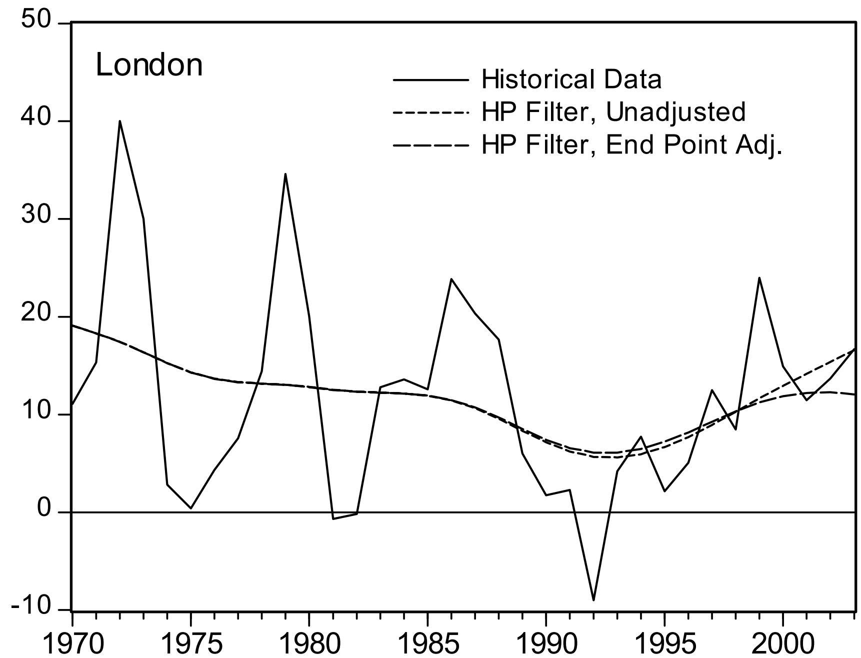
[12] Following standard practice in the literature.

[13] More precisely the ratio of average council taxes 1993/94 to 2003/04 for 2 adults in band D, before transitional relief and benefits (for 1997/98 to 2004/05 ODPM, Table 2.2f in sterling, for 1993/04 to 1996/97 consolidated local authorities series), to simple average house prices of all dwellings (ODPM, Table 511, in sterling).

[14] Annual regional house price inflation was HP filtered using the standard λ=100. Unadjusted for end-point problems for 1970 to 2003, adjusted for 1970 to 2008.

filtered trends.[15] Despite recent valuation gains, there has been a remarkable decline in nominal house price volatility after 1990, which probably owes much to the switch in the monetary regime and the resulting greater overall price stability.[16]

Figure IV.3. House Price Inflation



Source: ODPM, Simple average house prices, all dwellings.

Calibrating the effect of taxes on the real user cost of housing

16. **Taxes modify the pattern of the user cost of housing.** Figure IV.4 illustrates how alternative calibrations of housing taxes affect the user cost of housing variable (in this example for London[17]). The solid line shows the real user cost of housing without taxes. The

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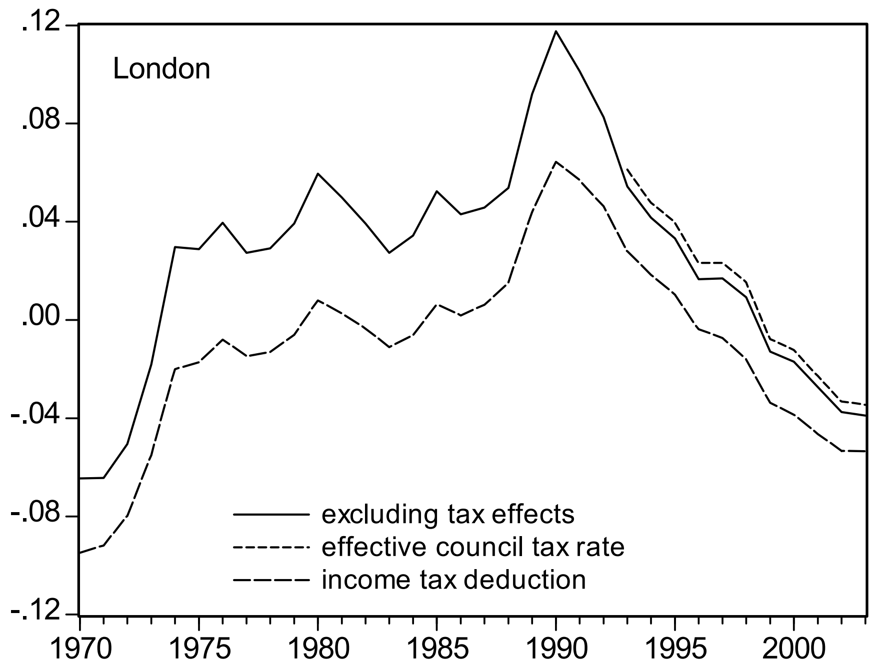
[15] Muellbauer and Murphy (1997) found that house prices in the South East are predicting U.K. house prices. Wood (2003) confirmed a leading role of house price inflation in London and the South East for the late 1980s and early 1990s, but not during other periods. In line with Wood's observation, the HP filter was applied to each region separately.

[16] The decline in volatility is also visible in some regions outside London, see Figure IV.A1 in the appendix.

[17] The picture looks similar for the other regions (available on request).

second line shows the impact of unlimited mortgage interest tax relief (MITR) assuming a 35 percent marginal income tax rate and 100 percent mortgage financing over the entire 1970–2003 period. In reality, the income tax treatment of mortgage payments has been more complicated. Tax laws and other factors, including the loan-to-value ratio, have been changing over time. Before the introduction of a 25,000-pound ceiling in 1974, MITR was available on any mortgage loan size. The tax relief was gradually reduced by under-adjusting nominal loan ceilings and later also by introducing restrictions on the applicable income tax rate. In April 2000, after its real value was largely eroded, MITR was finally abolished. The third line shows real user costs of housing including the effective council tax rate since 1993. The effective council tax rate in London declined from 0.7 percent to 0.4 percent, a 30 basis points decline, compared with a 340 basis points fall in the mortgage rate during the same period. The drop in house prices in the early 1990s was preceded by a sharp increase in the user costs of housing,[18] while the recovery in house price inflation was accompanied by a steady fall in user costs. About two thirds of the spike in user costs, as well as its subsequent easing was due to changes in mortgage rates, about one third may be explained by the measure of expected house price inflation.

Figure IV.4. Calibrating the Effect of Taxes on the User Costs of Housing



Source: Fund calculations.

[18] House prices fell considerably earlier in London than in the northern regions.

17. **The impact of the council tax is small within regions, but larger across regions reflecting sizeable differences in regional effective rates.** In general, the inclusion of tax variables changes the pattern of user costs over time only marginally. The effective council tax rate explains only about 3 percent of the fall in user costs of housing in London (about 5 percent in North East where the fall in user cost was smaller). Widespread mortgage credit constraints during the earlier period of very favorable tax treatment, and its erosion since the mid-1970s, have mitigated the effects of the MITR on house prices. Therefore the user cost variable used in the equations reported below excludes taxes.

Estimation results

18. **The price equation performs well; all parameters have the expected signs, reasonable magnitudes, and are robust over time and across estimation methods.** Estimation results over the full time range (1972–2003) confirm expectations; all coefficients have the right sign, as well as a sufficient significance level, and lie well within the range of results reported in the literature. The overall test statistics are also satisfactory. More importantly, demographic effects were the major difference between the first equation, covering also Wales and Scotland, and the other equations, covering only the regions of England. In England, the elasticity of house prices with respect to real income is around 1.6, and with respect to the user costs of housing around -0.5. Both are plausible magnitudes, given important supply restrictions. The equation seems also to be reasonably stable over time. The major difference again being demographics, which seem to have played a larger role in the earlier period 1972–93 than over the full sample. Despite first differencing of all the variables, heterogeneity across regions might still be present in the estimated equation. This is partly so because regional effective property tax rates—the stamp tax and council tax rates, as well as its predecessor rates—have been time varying. Regional heterogeneity is captured by fixed effects (FE) or random effects (RE) estimation. Overall, the coefficients changed little compared to simple OLS. With respect to the coefficient on *uch,* which is of particular interest here, this implies that heterogeneity, whether or not caused by declining effective council tax rates, has very little effect. The estimated income elasticity was also quite robust, but the influence of demographic variables was sensitive to the estimation method.

Table IV.1. Estimation Results

	Great Britain		England							
Sample (adjusted):	1972 2003		1972 2003		1972 2003		1972 2003		1972 1992	
Included observations:	34		32		32		32		21	
Cross-sections included:	11		9		9		9		9	
Total pool observations: (all balanced)	352		288		288		288		189	
Estimation method	FE		OLS		FE		RE	Swamy-Arora	OLS	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
constant	-0.009	-2.1	-0.008	-1.0	-0.015	-1.5	-0.008	-1.0	-0.012	-1.2
$D(LOG(H_{it}))$	0.393	2.9	1.081	1.5	1.811	1.9	1.081	1.5	1.611	1.8
$D(LOG(Y_{it}))$	1.494	26.8	1.600	24.7	1.600	24.4	1.600	24.4	1.689	20.1
$D(UCH_{it})$	-0.395	-2.3	-0.512	-2.4	-0.509	-2.3	-0.512	-2.3	-0.896	-2.9
Effects Specification										
	fixed				fixed					
Cross-section random S.D. / Rho							0			
Idiosyncratic random S.D. / Rho							0.058257			
R-squared	0.717		0.692		0.692		0.694		0.724	
Adjusted R-squared	0.705		0.689		0.689		0.682		0.719	
S.E. of regression	0.054		0.058		0.058		0.058		0.062	
Sum squared resid	1.001		0.941		0.941		0.937		0.701	
Mean dependent var	0.033		0.035		0.035		0.035		0.022	
S.D. dependent var	0.100		0.103		0.103		0.103		0.116	
Durbin-Watson stat	1.771		1.625		1.625		1.612		1.688	
F-statistic	60.894		213.187		213.187		56.912		161.643	

19. **However, house price dynamics might have changed since the mid-1990s.** When the estimation range is significantly shortened to cover the era before the introduction of the council tax (in 1993) the estimated parameters changed significantly, though still remaining rightly signed and within a reasonably range. The impact of the number of households has sharply declined (however, its coefficient was only marginally significant). The income elasticity remained little changed at 1.69 (compared to 1.60 for the full sample), and the user cost variable became more important with a semi elasticity of -0.90 (against -0.51 for the full sample). The robustness of the estimation results over time with respect to income and user cost of housing is reassuring, and the direction of change is congruent with a more stable monetary environment since the mid-1990s and the decline in relative importance of credit restrictions in the 1970s. Though the reasons for the declining influence of demographic variables since 1993 are unclear.

20. **The effect of council taxes on house price inflation is more important across regions than over time.** To disentangle the two effects, calculations based on estimated parameters show that the contribution of the effective council tax rate to regional house price increases varies between -0.9 percentage points in the North East to +1.1 percentage points in London and the South West, or about half of the difference in average inflation rates across regions (Table IV.2). However, the impact over time of a declining effective tax rate when house prices were rising was minor, and at 0.2 a little stronger where the decline in percentage points was largest (North East). In the regions that are often seen as setting the pace of house price increases (South West and London), the level of the effective tax rate is

simply too small to have a major impact, because even a sharp increase in house prices will reduce the effective tax rate only by a few basis points.

Table IV.2. Back-of-the-Envelop Impact of Declining Council Tax Rates on House Prices

(percentage points)	*Dimension over time*		*Dimension across Regions*			***Total***
	Effective tax rate		Real house price increase			
	Decline 97-03	Impact on house price	(annual aver.)	deviation from mean	Impact on house price	Impact (row 2+5)
North East	0.4	0.2	7.7	-2.1	-1.1	-0.9
North West	0.4	0.2	7.9	-1.9	-1.0	-0.8
Yorkshire & the Humber	0.3	0.2	8.4	-1.4	-0.7	-0.6
East Midlands	0.4	0.2	9.6	-0.3	-0.1	0.1
West Midlands	0.3	0.1	8.9	-0.9	-0.5	-0.3
East of England	0.2	0.1	11.3	1.5	0.8	0.9
London	0.2	0.1	11.8	2.0	1.0	1.1
South East	0.2	0.1	11.0	1.2	0.6	0.7
South West	0.3	0.2	11.8	1.9	1.0	1.1
England						
average	0.3	0.2	9.8	0.0	0.0	**0.2**
max deviation	0.2	0.1		4.1	2.1	**2.2**

The impact of the council tax rate on house price inflation over the 1997 to 2003 period has been calculated by adding up the product of the decline in the effective tax rate by the estimated semi elasticity of user costs of housing (-0.51) and the product of the difference in regional house price increases from the English average by the same semi elasticity. The council tax has uniformly contributed to house price inflation over time, though the extent of its contribution was minor (0.1 to 0.2 percent per year). Its contribution across regions was more significant, ranging from -0.9 in the North East to +1.1 in London and the South West.

21. **The last decade has seen important regime changes that might have modified house price behavior.** The estimation results need to be interpreted cautiously. There are some econometric shortcomings, such as the short time period, the representation of expected capital gains, or the omission of potentially important variables.[19] More importantly, the 1990s was a period of regime changes, in particular monetary policy was reoriented towards inflation targeting. As a result consumer price inflation converged towards a lower rate and became more stable, as did the economy as a whole. Also house prices, have been less volatile (see Figure IV.4 above) since the mid-1990s. Finally, the council tax was introduced in 1993. However, to what extent this represents a regime change rather than a modification of previous tax regimes remains an open question.

[19] Efforts to include the housing stock by regions were unsuccessful, producing implausible signs; good rent data were unavailable, neither were data on regional wealth holdings.

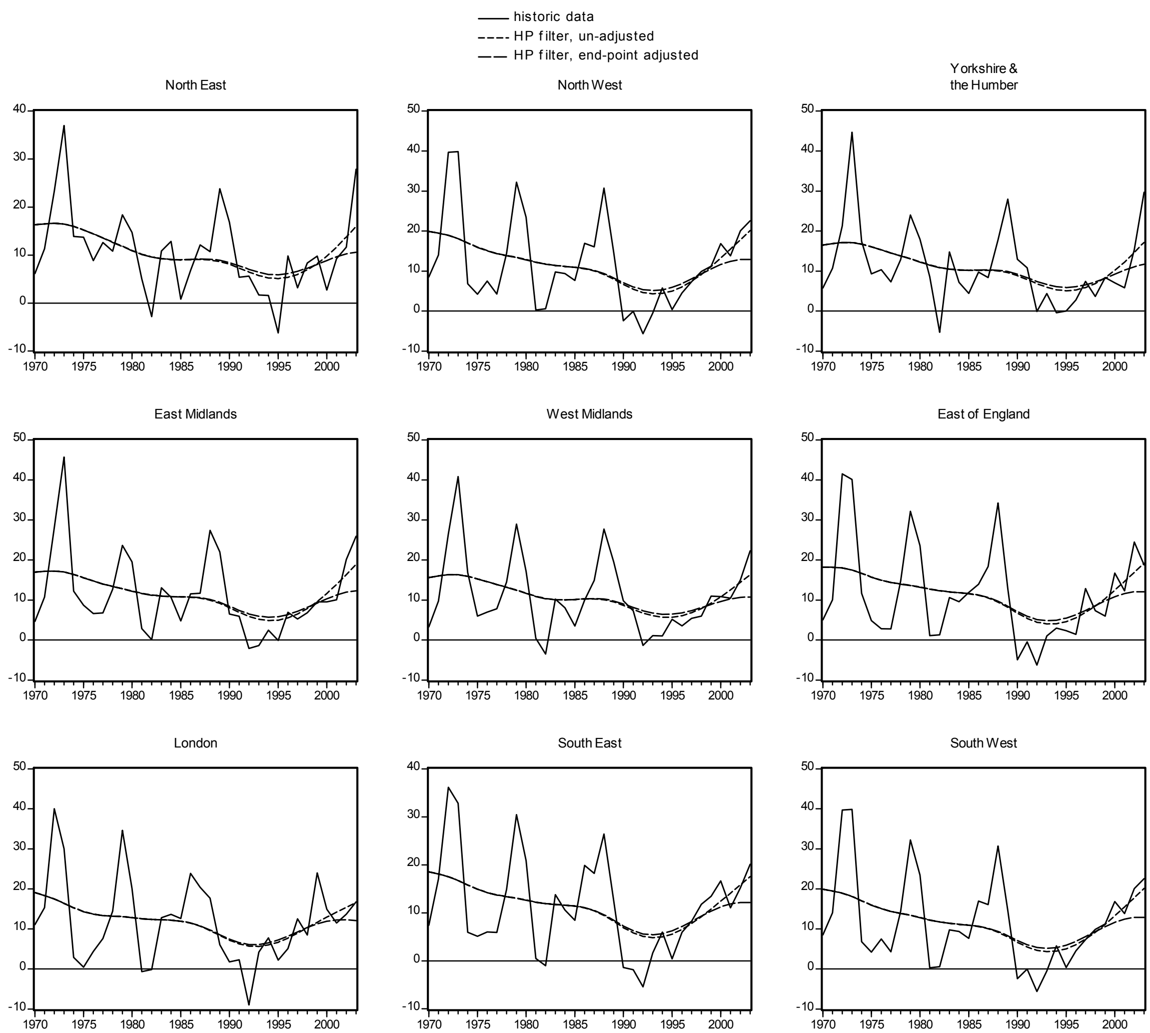
D. Conclusions

22. **The council tax may explain a significant part of cross-regional differences in house price inflation, but its influence over time was minor.** Although property taxes contribute to the real user cost of housing, they have only a minor impact compared to the effects of mortgage interest rates and expected capital gains. At about one percent of actual property values, the effective council tax rate is of a comparable magnitude with rates in other countries in the EU and the USA, but is too small in absolute size to have a major impact on house prices at high house price inflation rates. Consequently, the direct effect of a reformed council tax on house price volatility in the United Kingdom is likely to be small.

23. **A reformed property tax could nevertheless make a contribution to reducing overall macroeconomic volatility through its effect on disposable income.** The contribution that a reformed council tax could make would have to work through income withdrawal in response to strong house price increases. This could then help stabilize overall economic activity to the extent that some households face constraints that prevent them from borrowing to smooth consumption. Annual property reassessments would ensure that the council tax no longer suffers from the adverse decline in its effective rate when house prices rise. Also, a uniform national council tax rate would help to reduce regional disparities.

24. **Even so, these stabilization effects would come at the expense of local discretion over revenues, and might reduce certainty with respect to local government income.** Reforming property taxes will therefore have to balance potential, and probably small, macroeconomic benefits against local governments' interests in greater fiscal autonomy and predictability of revenues. To better inform its decision making, the U.K. government has appointed Sir Michael Lyons to carry out an independent inquiry into the detailed case for changes to the present system of local government funding. The inquiry is also supposed to make recommendations by the end of 2005 on how best to reform the council tax, taking into account the forthcoming revaluation of domestic property.

Figure IV.A1. House Prices and Expectations by English Regions
(annual percentage change)



References

Adam, S. and J. Shaw, 2003, A Survey of U.K. Tax System, IFS, Briefing Note 9.

Aoki, K., J. Proudman, G. Vlieghe, 2002, House Prices, Consumption, and Monetary Policy : A Financial Accelerator Approach, Bank of England, Working Paper 169.

Barham, G., 2004, The Effect of Taxation Policy on the Cost of Capital in Housing – A Historical Profile (1976 to 2003), in: Bank of Ireland, Financial Stability Report.

Barker, K., 2003, Review of Housing Supply – Securing our Future Needs, Interim Report – Analysis, Chapter 7.

Barker, K., 2004, Review of Housing Supply, Delivering Stability: Securing our Future Housing Needs, Final Report – Recommendations, Recommendation 2.

Choi, I., 2001, Unit Root Tests for Panel Data, Journal of International Money and Finance, 249-272.

Danmarks Nationalbank, 2003, MONA – A Quarterly Model of the Danish Economy.

Gallin, J., 2003, The Long-Run Relationship Between House Prices and Income: Evidence from Local Housing Markets, Federal Reserve Board DP.

HM Treasury, 2003, Fiscal Stabilisation and EMU: A Discussion Paper.

HM Treasury, 2003, Housing, Consumption and EMU: EMU study

Institute for Fiscal Studies, 2004, Green Budget, 5. The taxation of housing.

Kearl, J.A., 1979, Inflation, Mortgage, and Housing, The Journal of Political Economy, 1115-1138.

Maclennan, D., J. Muellbauer, M. Stephens, 1998, Asymmetries in Housing and Financial Market Institutions and EMU, Oxford Review of Economic Policy, 54-80.

Meen, G. and M. Andrew, Modeling Regional House Prices: a review of the literature, Department of the Environment, Transport and the Regions.

Meen, G. and M. Andrew, 1998, On the Aggregate Housing Market Implications of Labour Market Change, Scottish Journal of Political Economy, 393-419.

Miles, D., 2004, The U.K. Mortgage Market: Taking a Longer-Term View, HM Treasury.

Muellbauer, J and A. Murphy, 1997, Booms and Busts in the U.K. Housing Market, The Economic Journal, 1701-1727.

Muellbauer, J., 2003, The U.K. and the Euro – the Role of Asymmetries in Housing and Credit Markets, EMU Studies 19.

Muellbauer, J., 2004, Property and Land, Taxation and the Economy after the Barker Review, Nuffield College, Oxford.

Muellbauer, J. and G. Cameron, 2000, Five Key Council Tax Reforms and Twelve Reasons to Enact Them, New Economy, www.housingoutlook.co.U.K./Papers/tax.html.

OECD, 2004, OECD Economic Surveys: United Kingdom, Chapter II: Reducing the risk of instability from the housing market.

Poterba, J.M., 1984, Tax Subsidies to Owner-Occupied Housing: An Asset-Market Approach, The Quarterly Journal of Economics, 729-752.

Poterba, J.M., 1991, House Price Dynamics: The Role of Tax Policy and Demography, Brookings Papers on Economic Activity, 2, 143-183.

Smith, L.B., K.T. Rosen, G. Fallis, 1988, Recent Developments in Economic Models of Housing Markets, Journal of Economic Literature, 29-64.

Thwaites, G., and R. Wood, 2003, The Measurement of House Prices, Bank of England Quarterly Bulletin: Spring 2003, 38-46.

Van den Noord, P., 2003, Tax Incentives and House Price Volatility in the Euro Area: Theory and Evidence, OECD Economics Department Working Paper No. 356.

Weeken, O., 2004, Asset Pricing and the Housing Market, Bank of England Quarterly Bulletin, Spring 2004, 32-71.

Wood, R., 2003, The Information Content of Regional House Prices: Can They Be Used To Improve National House Price Forecasts?, Bank of England Quarterly Bulletin: Autumn 2003, 304-314.