

A number of modelling techniques have been used to compare the overall strength of the transmission mechanism across countries.

A study by Smets (1995) compares the cross-country responses to a monetary policy shock using the different country-specific macroeconomic models maintained by national central banks. This study stands out as suggesting that the UK has a significantly stronger output response than euro area countries.

However, results from the Treasury Public Model estimate that the UK response to the same monetary policy shock is less strong in the first three years than in Smets (1995) and broadly in line with the results for the euro area countries. The Bank of England (2000) model also estimates a lower UK output response than in Smets (1995).

A different modelling approach is to apply the same theoretical model across countries. This technique often finds that differences in transmission mechanisms are quite low. The UK does not appear to be an obvious outlier when looking across the results of all these studies. Results from structural vector auto-regression (SVAR) studies also suggest that the UK response to monetary policy shocks is similar to most euro area countries.

There are technical issues with each of these approaches. The Smets (1995) approach uses different models for each country, so variations in responses may be due to theoretical differences in model specification. On the other hand, imposing a common theoretical model across countries will mean that the effects of real structural differences, such as housing markets in the UK, are not fully captured.

4.1 The structural analysis in the previous section highlights a number of factors which could lead to differences in monetary transmission mechanisms. However, it is hard to gauge the overall relative strength of a country's transmission mechanism through such analysis. This section takes an alternative approach. It considers economic models which attempt to measure the strength of the transmission mechanism at the aggregate level, and to compare this across countries. A variety of econometric modelling techniques have been used to do this. Kieler and Saarenheimo (1998) divide empirical models of the transmission mechanism into five categories:

- large-scale macroeconometric single country models;
- large-scale multi-country models;
- small-scale structural models;
- single equation models; and
- SVAR (structural vector auto-regression) models.

A review of the empirical literature

4.2 This section reviews key existing studies in each of these categories. It is important to recognise that most of the existing studies have been undertaken on the basis of the domestic reaction to a national monetary policy shock. However, EMU is likely to have a significant impact on the operation of monetary policy and on the nature of the transmission mechanism. In addition, the ability to draw direct comparisons between transmission mechanism models (and in some cases, across countries within the same model) is limited by the different modelling assumptions used. Kieler and Saarenheimo (1998) identify two key differences:

- first, different models use different exchange rate assumptions. For example, the study by Smets (1995) shows the UK to be more interest rate sensitive than euro area countries, but explicitly assumes a floating exchange rate for sterling against fixed internal exchange rates for the ERM members, thus limiting its use as a practical tool in assessing UK membership of EMU; and
- second, different types of monetary shocks are simulated, such as temporary or permanent interest rate shocks, money stock target shocks, or shocks to interest rate reaction functions. As Kieler and Saarenheimo (1998) state: “*none of the studies reported, with the exception of Dornbusch, Favero and Giavazzi (1998), attempts to estimate the impact of the type of common monetary shock which will occur in EMU, namely a simultaneous and equal change in policy interest rates with fixed exchange rates among participating countries*” (page 6).

4.3 Because none of the existing studies fully address the particular issues that are important when considering UK entry to EMU, HM Treasury has undertaken a new modelling exercise based on the National Institute Global Econometric Model (NiGEM), which can model the UK response to changes in monetary policy as if it were in EMU. The results are presented in Section 5.

4.4 A further problem relates to the identification of the effect of monetary policy on output and prices. Monetary policy is largely an endogenous variable which may react directly to changes in output and prices, as well as affect them. It is therefore not straightforward to identify causality using econometric modelling techniques.

**Large-scale
macro-
econometric
single country
models**

4.5 The large-scale macroeconomic single country technique compares results when an identical monetary shock is fed into independent country-specific models. The most widely cited work using this technique is a 1995 project coordinated by Frank Smets at the Bank for International Settlements. The project brought together the results of a coordinated modelling exercise undertaken on national central bank macroeconomic models, each responding to a pre-agreed simulation of a temporary one percentage point increase in policy rates for two years.

4.6 Table 4.1 shows the principal results for the models of the US, UK and other EU economies:

- the left half of the table shows the effect of the one percentage point increase in short-term interest rates on output. The effect on the UK is greater in the first three years of the simulation than in euro area countries. It is roughly twice the order of the effects on Germany and France; and
- similarly, the effects on consumer prices shown in the right half of the table are significantly different in the UK. Unlike all other countries sampled, UK headline RPI (Retail Prices Index) increases in the two years of the monetary tightening, before slowing at a faster rate in the later years of the sample. This is due to the influence of mortgage payments in the headline RPI.¹ Once again, French and German responses are fairly similar.

¹ Box 4.2 indicates the different impact on consumer prices in the Treasury Public Model when using RPI and RPIX.

Table 4.1: Effects of a temporary one percentage point increase in short-term interest rates for two years (Smets, 1995)

Percentage point deviation from base	Output					Consumer Prices				
	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
Endogenous exchange rate										
UK	-0.35	-0.89	-0.59	0.01	0.24	0.89	1.27	-0.46	-2.36	-3.48
Germany	-0.15	-0.37	-0.30	-0.07	0.09	-0.03	-0.14	-0.31	-0.45	-0.55
Italy	-0.32	-0.53	-0.22	-0.08	-0.13	-0.48	-0.64	-0.53	-0.17	0.10
Spain	-0.05	-0.02	0.03	-0.17	-0.17	-0.26	-0.54	-0.66	-0.95	-1.28
Austria	-0.08	-0.14	-0.02	0.04	0.01	-0.02	-0.04	-0.05	-0.04	-0.02
US	-0.07	-0.50	-1.21	-1.80	-2.09	-0.03	-0.21	-0.68	-1.56	-2.90
Fixed within ERM										
France	-0.18	-0.36	-0.20	0.01	0.07	-0.05	-0.15	-0.25	-0.32	-0.32
Netherlands	-0.10	-0.18	-0.15	-0.09	-0.01	-0.13	-0.35	-0.35	-0.23	-0.27
Belgium	-0.03	-0.12	-0.23	-0.15	0.02	-0.14	-0.48	-0.79	-0.81	-0.55

Note: UK consumer prices measure is headline RPI.
Source: Smets, 1995.

Table 4.2: Output effects by transmission channel, after a one percentage point increase in short-term interest rates for two years (Smets 1995)

Percentage point contribution to changes in output	Total	Domestic Channels	of which:				Exchange Rate Channel
			Income/ Cash Flow	Wealth	Direct Interest Rate Effect	Cost of Capital	
First year after shock							
UK	-0.35	-0.32	-0.11	-0.17	-0.04	-	-0.02
Germany	-0.15	-0.03	0.02	-	-0.06	0.01	-0.09
France	-0.18	-0.03	0.10	-	0.00	-0.13	-0.09
Italy	-0.32	-0.12	-0.01	-	-0.05	-0.06	-0.21
Spain	-0.05	-0.02	0.00	-0.01	-0.02	0.01	-0.03
Austria	-0.08	-0.02	0.01	0.00	-0.03	0.00	-0.06
Netherlands	-0.10	-0.03	0.00	-0.01	-0.01	-0.01	-0.07
Belgium	-0.03	0.00	0.01	0.00	-0.02	0.01	-0.05
US	-0.07	-0.04	0.06	-0.01	-0.03	-0.06	-0.01
Second year after shock							
UK	-0.89	-0.78	-0.27	-0.29	-0.22	-	-0.11
Germany	-0.37	-0.10	0.05	-	-0.14	-0.01	-0.24
France	-0.36	-0.11	0.07	-	-0.01	-0.17	-0.21
Italy	-0.53	-0.29	0.02	-	-0.10	-0.21	-0.24
Spain	-0.02	0.00	0.00	0.02	-0.02	0.00	-0.06
Austria	-0.14	-0.07	0.01	0.02	-0.02	-0.08	-0.05
Netherlands	-0.18	-0.12	-0.01	-0.03	-0.03	-0.05	-0.07
Belgium	-0.12	-0.02	0.15	0.00	-0.14	-0.03	-0.12
US	-0.50	-0.39	0.18	-0.14	-0.14	-0.29	-0.06

Source: Smets 1995.

4.7 Table 4.2 indicates which of the principal transmission channels are responsible for the changes in GDP in each country in Smets (1995). Breaking up the effects of the monetary tightening in this way allows a better understanding of how national mechanisms appear to differ in the different central bank models:

- the UK's relatively strong response to the tightening is shown again in the first column. The total response of output to the rise in policy rates is higher than for the other countries listed;
- the subsequent columns show that in both the first and second years following the shock it is through domestic channels that the majority of the impact on GDP is felt in the UK – primarily through the income channel and wealth effects; and
- this compares starkly with the Bundesbank model of the German economy, where income effects are weak and stimulatory and there are no wealth effects allowed for.

4.8 The euro area economies, including France, follow a pattern more similar to Germany. For Italy, the Banca d'Italia model estimates a significant impact on Italian output through the exchange rate channel. This suggests that by joining EMU one possible cause of asymmetry in Italian monetary transmission would have been eliminated.

4.9 Smets (1995) has frequently been cited as evidence that the UK is an outlier among the four large EU economies in terms of monetary transmission, with monetary policy tending to have a significantly larger effect on UK output. But as noted previously, and acknowledged by Smets, it is difficult to know to what extent different results are due to differences in the theoretical basis of the models, for example, the way in which expectations are modelled.

4.10 However, some differences in modelling approaches may reflect actual structural differences between economies. As Smets (1995) points out, in the Bank of England model spending components depend almost exclusively on short-term as opposed to long-term interest rates. In other models, spending is determined to a greater degree by long-term interest rates. It is not surprising, therefore, that the Bank of England model shows a strong and rapid effect of monetary policy on demand. The importance of short-term interest rates in the Bank of England model reflects the modellers' perception that firms and households in the UK are exposed to variable rate debt.

4.11 The Bank of England model used in this exercise has since been updated. Box 4.1 describes the Bank of England's approach to modelling the transmission mechanism of monetary policy and presents more recent estimates of the impact of a one percentage point rise in interest rates on output and inflation. The output response in the more recent model is less strong than reported in Smets (1995), with a maximum effect of 0.25 percentage points occurring after one year.

Box 4.1: Modelling of the transmission mechanism of monetary policy at the Bank of England.

Since the Bank of England was granted operational independence in May 1997, monetary policy in the UK has been implemented by the Monetary Policy Committee. Their views on how interest rate changes might impinge on inflation through the main channels of monetary policy were published in 2001 (see Monetary Policy Committee, 2001).

A more detailed account of the models drawn on by the Committee in making their interest-rate setting decisions was published in Bank of England (1999). This described the 'suite of models' modelling philosophy adopted by the Bank and gave a comprehensive account of the different approaches taken to inform the policy process. These included:

- the medium term macroeconometric model (MTMM), the main 'structural modelling' tool used to produce the quarterly forecast process as described in the Bank's Inflation Report; and
- other models including vector autoregressive (VAR) models, used to analyse the statistical properties of inflation; small analytical models, used to inform the policy design process; and more theoretically rigorous 'optimising models', used to address particular issues.

A detailed equation listing of the MTMM was published by the Bank for the first time in Bank of England (1999) and updated in Bank of England (2000).^a These publications include a description of the simulation properties of the predicted response of inflation and output to a one percentage point rise in short-term interest rates sustained for one year (i.e. the simulation which is analogous to those considered for other models elsewhere in this study). The key features of the response are:

- output falls with a short lag, its maximum effect of 0.25 percentage points occurring after one year; while
- RPIX inflation responds more slowly, partly in response to the delayed effect on output, taking two years for interest rates to have their maximum impact of 0.3 percentage points.

Recently, the MTMM has been criticised on the grounds that it does not represent the state of the art in terms of econometric modelling (see Pagan, 2003). A new model is currently being developed at the Bank that is intended to provide a more useful tool to aid the MPC's deliberations.

^a Previously, the only published account of the Bank of England's approach to modelling the transmission mechanism was contained in Dhar *et al.* (1995).

4.12 Another issue with this approach is that it simulates a floating exchange rate regime for the UK, which clearly would not be the case for intra-euro area exchange rates if the UK were to join EMU. However, the results in Table 4.2 show a relatively weak exchange rate channel in the UK. This is in contrast to results from the Treasury Public Model (see Box 4.2) where the exchange rate channel is found to be strong.

Box 4.2: Monetary transmission in the 2002 Treasury Public Model

This box presents results produced by HM Treasury using the Treasury Public Model of the UK economy to simulate a monetary policy shock. The table below gives estimates of the impact on GDP and inflation of a one percentage point increase in interest rates for two years, the benchmark monetary policy shock.

The Treasury model estimates that the reaction of GDP to an increase in interest rates is less strong in the first three years than in Smets (1995), at –0.4 percentage points in the Treasury model compared to –0.9 percentage points in Smets. The results for RPIX inflation indicate the importance of mortgage payments in the headline RPI. In the first two years, the impact of an increase in interest rates is to increase headline inflation, through rising mortgage payments, while RPIX inflation falls. This is a limitation in Smets, which only uses the headline RPI for the UK. Another feature of the Treasury Public Model, which contrasts with models such as Smets, is that the exchange rate channel is found to be relatively important in the UK.

Effects of a temporary one percentage point increase in interest rates for two years (Treasury Public Model 2002)

Year	Percentage point deviation from base		
	GDP	Inflation (RPI)	Inflation (RPIX)
1	–0.2	0.7	0.0
2	–0.4	0.5	–0.2
3	–0.2	–0.5	–0.3
4	0.1	–0.6	–0.1
5	0.0	–0.6	0.0

Source: HM Treasury.

Overall, estimates of the strength of the UK transmission mechanism in the Treasury Public Model are broadly in line with the Smets results for euro area countries. In Smets the impact on GDP after two years is –0.4 percentage points in Germany and France, –0.5 percentage points in Italy and –0.2 percentage points in the Netherlands. More generally, the Treasury Public Model estimates are also broadly in line with those found by studies using other estimation methods, which can be seen from the following analysis and the summary Table 4.7.

Large-scale macro-econometric multi-country models

4.13 The large-scale macroeconomic multi-country technique applies a model with a single theoretical structure to different countries and compares the results. This reduces the likelihood of differences in model theoretical specification being responsible for differences in results. However, in this approach the model may fail to capture genuine structural characteristics or features of particular economies. Such ‘common-form’ models tend to display a greater degree of homogeneity in responses than those estimated by country-specific models.

4.14 The Commission Service's QUEST model is a multi-country framework model used for simulating the effects of economic policy both on the domestic and international economy. Röger and in't Veld (2002) simulate a variety of shocks using this model, including the effect of a temporary increase in short-term interest rates of one percentage point for one year worldwide.²

4.15 Table 4.3 brings together the output and inflation responses for the large EU economies. The UK's behaviour is broadly similar to that of the other countries, and to the euro area as a whole. The reductions in output from the interest rate increase are of a similar scale in each of the large EU economies, the UK experiences a decrease of 0.4 per cent in the first year compared to 0.5 per cent in Germany.

Table 4.3: Effects of a temporary one percentage point increase in the short-term interest rate for one year (Röger and in't Veld, 2002)

Percentage point deviation from base	Output					Inflation				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
UK	-0.40	-0.10	-0.03	-0.02	-0.02	-0.13	-0.08	0.00	0.00	0.00
Euro area	-0.45	-0.10	-0.03	-0.02	-0.02	-0.14	-0.08	0.01	0.00	0.00
Germany	-0.48	-0.11	-0.04	-0.03	-0.02	-0.13	-0.07	0.00	0.00	0.00
France	-0.41	-0.10	-0.02	-0.02	-0.02	-0.14	-0.07	0.01	0.01	0.00
Italy	-0.44	-0.08	-0.02	-0.02	-0.02	-0.14	-0.08	0.00	0.00	0.00

Source: Röger and in't Veld, 2002.

4.16 Oxford Economic Forecasting (OEF, 2002) use a global macroeconomic model to compare the impact of a one percentage point increase in interest rates for one year in the UK and in the euro area. OEF model a number of scenarios, including the UK outside EMU and the UK inside EMU. The results in Table 4.4 show a slightly stronger initial impact on GDP in the UK than in the euro area when the UK is out of EMU. The difference increases with the UK inside EMU, in particular in year two, as the model assumes that the ECB is slower to reverse the initial tightening of policy than is the Bank of England.

Table 4.4: Effects of a temporary one percentage point increase in the interest rate for one year (Oxford Economic Forecasting, 2002)

Percentage point deviation of GDP from base	UK					Euro area				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
UK out of EMU	-0.7	-0.6	0.4	-0.1	-0.3	-0.5	-0.5	-0.1	-0.1	-0.1
UK in EMU	-0.6	-1.1	-0.2	0.7	1.2	-0.5	-0.5	-0.1	0.1	0.2

Source: OEF, 2002.

4.17 OEF (2003) updates these estimates and finds a larger gap between UK and euro area output response. In the new estimates the output response of the UK in EMU after two years is -1.7 percentage points, compared to -0.4 percentage points for the euro area. OEF (2003) also estimates the UK output response using a model which attempts to remove the impact of the housing market. In this case, the UK output response after two years is -1.4 percentage points.

4.18 Masson *et al.* (1990) provide a general overview of the use of the IMF's MULTIMOD model in analysing macroeconomic variables in the industrialised countries. While this study does not focus on the monetary transmission mechanism, it does present the results of MULTIMOD simulations of increases in domestic money supply targets for the UK and Germany, shown in Table 4.5.

² The simulation covers the euro area, UK, Denmark and Sweden, and the US and Japan.

Table 4.5: Effects of a 10 percentage point increase in the domestic money supply target (Masson et al. 1990)

Percentage point deviation from base		1990	1991	1992	1993	1994	1995
Output ¹	UK	2.1	4.6	5.3	4.5	2.9	1.0
	Germany	5.6	5.0	2.7	0.3	-1.2	-1.7
Prices ²	UK	0.5	1.3	2.8	5.0	7.3	9.4
	Germany	1.6	4.5	7.4	9.6	10.6	10.8

¹ Real Gross National Product.

² Measured by the GNP deflator.

Source: Masson et al. 1990.

4.19 The MULTIMOD simulations imply that UK output is somewhat less sensitive to changes in the money supply than Germany in the first year of the simulation, but has a stronger reaction in later years. The response of UK prices is weaker than Germany's throughout the reported period. Part of the reason for asymmetries may be due to differences in the strength of the effect of changes in money supply on interest rates and inflation. As neither of these countries have been using money supply targets as the primary monetary policy target for some time, the relevance of this approach is limited.

4.20 Kieler and Saarenheimo (1998) and Borio (1995) report the results of two further multi-country models. Simulations on the US Federal Reserve multi-country model use the same shock as Smets (1995), but with fully endogenous exchange rates. The results suggest a stronger response than average in the UK and a smaller one in Italy. Taylor (1993) models the transmission mechanism for a group of countries – the US, Canada, UK, Germany, France, Italy and Japan – based on financial market prices. This model finds a much smaller output response for the UK compared to Germany, France and Italy, primarily because UK investment and consumption react less strongly.

4.21 Multi-country models provide inconsistent evidence on the relative strength of the transmission mechanism. In general they point to smaller differences between countries than the country-specific modelling approach in Smets (1995), including for the UK. However, as discussed above, these models generally display a greater degree of homogeneity than single country models, due to the symmetry in structural forms across countries.

Small structural models

4.22 Large-scale macroeconomic models represent an informative means of modelling how the economy might respond to different shocks under alternative monetary policy regimes. One disadvantage though, is that they can be complicated to understand and the results difficult to interpret, and so there is a case for adopting a simpler stylised model that captures the essential features of the transmission mechanism of monetary policy.³ An example of this approach is Britton and Whitley (1997), who use a variant of the Mundell-Fleming model. They find that cross-country differences are generally not significant. This technique, applying the same small structural model across countries, is open to the same kind of criticism as the multi-country macroeconomic model technique. The small models also take a highly aggregated approach and so may neglect the more peripheral channels of transmission.

³ Such a model has been employed in the EMU study *Modelling shocks and adjustment mechanisms in EMU* to analyse how the UK might adjust to shocks inside and outside the EMU, this model is discussed further in Section 5.

Single equation models **4.23** Dornbusch *et al.* (1998) estimate a single equation for output growth in six EU countries based on past domestic and foreign output, past and present interest rates and past and present bilateral exchange rates against the deutschmark and US dollar. By fixing intra euro area exchange rates, this methodology is used to simulate the effects of a fixed exchange rate system. The principal results are given in Table 4.6. The impact on output of a change in the money supply target is similar in the UK, Germany and France, with stronger effects in Sweden and Italy, and a somewhat weaker effect in Spain. After two years, output in the UK is shown to react to a lesser extent than in other countries.

Table 4.6: Effects of a permanent increase in all expected short-term interest rates with constant intra-European exchange rate (Dornbusch *et al.* 1998)

Elasticities of output	Impact effect	Effect after 2 years
UK	0.47	0.90
Germany	0.54	1.40
France	0.46	1.54
Italy	1.11	2.14
Spain	0.35	1.54
Sweden	0.95	2.36

Source: Dornbusch *et al.* 1998.

4.24 The single equation approach also suffers from technical problems associated with small-scale models. The impact of regime changes during the sample period from 1985 through to 1995 – the UK's exit from the ERM for example – may not be reflected. Finally, as Kieler and Saaranheimo (1998) point out, it is difficult to rationalise the structure of single equation models using economic theory.

Structural vector auto-regressions (SVARs) **4.25** SVARs model a set of variables as dependent on each other (subject to certain identifying restrictions) and on lags of all variables. A number of methodological problems have been identified with the SVAR approach, see Guiso *et al.* (2000) and Maclennan *et al.* (2000).⁴ These problems notwithstanding, SVARs have been widely used to model the transmission mechanism.

4.26 For example, Ramaswamy and Sløk (1998) test for robustness by modelling alternative specifications of the VAR methodology. The principal finding is that EU countries can be separated into a core and periphery of nations, based on an assessment of how long output is estimated to take to bottom out following a monetary shock. The UK is not considered to be an outlier, showing similarities with German responses in particular.

4.27 Dedola and Lippi (2000) estimate the impact of an unanticipated monetary shock on 21 manufacturing industries in five countries. The objective is to examine whether some sectors are more sensitive to monetary policy than others, and to examine the implications at the country level. The results offer some support for the argument that Germany may be more sensitive to monetary policy changes due to its relatively large manufacturing sector. The results show similar responses in the UK, France and Italy.

⁴ One problem is that the SVAR model's 'black-box' nature says little about what structures are causing any difference in response to monetary policy – merely that the overall effect is different. Omitted variables are also a problem; key asset prices (like the exchange rate), fiscal variables, and external policy, output and inflation and oil price shocks, are generally omitted from SVARs. The identification of the effects of monetary policy on the economy through VARs is also controversial.

4.28 Ehrmann (2000) uses an SVAR approach which allows for heterogeneity in the models estimated for each country. The UK exhibits a relatively long-lasting effect on output and inflation from a monetary impulse which takes longer to intensify. The total cumulative magnitude of the inflation response in the UK is low, close to that of France, and the cumulative magnitude of the UK's output response is similar to most euro area countries. Germany is the outlier with a larger cumulative output response than the other countries. However, the author notes that the UK results should be interpreted with caution as it is the only country in which the analytical time period spanned a number of different monetary policy regimes.

4.29 Earlier SVAR studies include Gerlach and Smets (1995) who use a three-variable SVAR model to examine the response of output to a short-term and a sustained monetary shock. They report that their results show little evidence of significant differences in transmission mechanisms across countries. Barran *et al.* (1996) use a VAR to model the impact on output of an interest rate shock in EU Member States. They find that the impact on GDP is relatively similar, both in terms of magnitude and timing, across all countries.

**Conclusions on
the review of
econometric
studies**

4.30 Table 4.7 summarises the results from key studies (adapted from Kieler and Saarenheimo, 1998), showing estimates from each model of the impact on output two years after a shock. The country-specific Smets (1995) study stands out as suggesting that the UK has a significantly different output response to euro area countries. However, both the Treasury Public Model and the Bank of England (2000) estimate a lower UK output response than in Smets (1995). Moreover, the multi-country models and most of the small models often find that differences in monetary transmission mechanisms are quite low. The UK does not appear to be an obvious outlier on the basis of these models.

4.31 There are technical issues with each of the modelling approaches considered in this study. The Smets (1995) single country approach uses different models for each country, so variations in responses may be due to theoretical differences in model specification rather than actual structural differences. On the other hand, imposing a common theoretical model across countries, as in the multi-country common-form models, means that real structural features of particular economies are not captured. The small models are highly simplified, potentially omitting variables which may be the source of variation. SVARs also rely on controversial technical identification assumptions.

4.32 The analysis in Section 3 suggests that the UK housing market is an important structural difference between the UK and the euro area. This difference will not be fully captured by studies which impose a common theoretical model across countries, such as multi-country common-form models or some of the small structural models. These models impose a single theoretical form on countries for a number of reasons, for example to reduce the likelihood of differences in model specifications being responsible for differences in results. But by doing this they fail to capture genuine structural features of particular economies, such as housing in the UK. This conflict between the desire to identify real structural differences and the need to minimise potential differences due to modelling approaches has not been satisfactorily resolved, despite extensive and on-going research by academics and international organisations.

4.33 Overall, empirical model-based studies do not demonstrate consistently that the UK transmission mechanism stands out in terms of leading to divergent outcomes. However, as noted above, many of these models do not fully reflect structural differences which exist in reality. The EMU study *Housing, consumption and EMU* by HM Treasury finds that although empirical evidence on the impact of changes in interest rates and housing wealth on consumption is not as clear cut as the evidence of structural differences, on balance it supports the view that the sensitivity of household spending through the housing market is higher in the UK than elsewhere.

4.34 An additional problem with these approaches is that they are mostly based on reactions to changes in national monetary policy, either with flexible or fixed exchange rates. This is a very different situation from EMU, where a single authority sets monetary policy⁵ and there are no nominal exchange rates between euro area countries. In an attempt to address this, HM Treasury has undertaken a new modelling exercise using the NiGEM global macroeconomic model to simulate the UK and euro area responses to a change in monetary policy as if the UK were inside EMU. The results are detailed in the following section.

4.35 Finally, the act of joining EMU might be expected to impact on financial and economic structures of participating economies, changing the way in which monetary policy will be transmitted. An understanding of the implications for differences in transmission mechanisms is considered in Section 6.

⁵ Clements *et al.* (2001) attempt to control for this problem by modelling responses of EMU members to a common monetary policy response, though they do not include the UK in the analysis. They find that even with a common monetary policy some heterogeneity remains across euro area countries.

Box 4.3: The ECB ‘Monetary Transmission Mechanism Network’ research and other empirical research into the credit channel

The ECB has recently undertaken a large research programme on the monetary transmission mechanism in the euro area. The research has three main components: macro modelling of the transmission mechanism at the euro area level; modelling using VAR techniques; and micro based modelling undertaken by national central banks at a domestic level, mainly using bank and firm data. The majority of the analysis is econometrically based, although some is structural in context, particularly concerning the euro area credit channel, and hence relates also to the discussion in Section 3 of this study.

The results of the research programme were published in a series of ECB Working Papers in December 2001^a and more recently in the ECB’s October 2002 *Monthly Bulletin*. The results of three macroeconomic modelling exercises, reported in the October Bulletin, suggest that at the aggregate euro area level, the impact of monetary policy on output peaks after one year, with a one percentage point rise in the policy rate leading to a maximum impact on output of between –0.3 and –0.7 percentage points. This is similar to the results found in HM Treasury’s NiGEM modelling, discussed in Section 5.

At the macro level, the results of macroeconomic modelling and VAR analysis suggest that changes in investment behaviour are the key driver of output after a monetary policy change.^b This is in contrast to the US where studies have typically found that changes in consumption behaviour are more important. ECB research has focused on examining the relative importance of the conventional interest rate channel versus the credit channel. For the euro area as a whole, the results suggest that the interest rate channel is important but not dominant – in many countries the credit channel also plays a role.

The credit channel in the euro area

On the basis of a series of micro-based studies, evidence was found to support the presence of a bank-lending channel in France, Germany, Greece, Italy, the Netherlands and Portugal, but not in Austria, Finland and Spain. Evidence supports the presence of a broad credit channel in Austria, Belgium, France and Italy, but not in other countries, most notably Germany.^c

A general conclusion was that the degree of bank liquidity was found to be the most important determinant of the impact of monetary policy changes on bank lending. Liquid banks may be able to use their liquid assets to protect their loan portfolio in the face of a monetary tightening. This is in contrast to most results from the US, where the size and financial health of banks is generally found to be the most significant factor. This could be because government ownership of banks in the euro area reduces the perceived risk of bank failure, so that banks can continue to secure capital after a monetary tightening. Another factor may be the presence of banking networks in the euro area, which can provide small or poorly financed banks with injections of capital in the event of a monetary policy tightening.

^a Available at www.ecb.int

^b A summary of the results of the programme is provided by Angeloni et al. 2002.

^c These results are generally in line with the structural analysis in Kashyap and Stein (1997), discussed in Section 3 of this paper.

The credit channel in the UK

How do these results compare with what is known about the UK monetary transmission mechanism? A number of studies have analysed the importance of the credit channel in the UK, but the results are far from conclusive, which is perhaps consistent with the evidence from structural indicators. As discussed in Section 3, UK firms do not tend to have close ties with banks, which may increase asymmetric information problems. On the other hand, UK firms are less dependent on bank finance than euro area countries; the banking sector is also strong and dominated by large institutions – indicators which suggest the credit channel may be weaker in the UK.

Ashworth *et al.* (2001) survey the literature and find evidence that firm-level investment in the UK is sensitive to cash flow, and that aggregate UK investment is sensitive to corporate profitability – both suggesting the presence of a **broad credit channel**. Two studies by Bond *et al.* (1997,1999) find that UK investment is more sensitive to cash flow than in euro area countries such as France and Germany. Ashworth and Davis (2001) find a negative relationship between debt to equity ratios and investment in all G7 countries bar Japan and Italy, which points to the operation of the broad credit channel. However, only in the US and Japan do they find evidence for the **bank-lending channel** in the relationship between loans to debt ratio and investment.

López-Iturriaga (2000) analyses the strength of the credit channel in twelve OECD countries by testing the relationship between investment and the availability of bank finance. The results suggest that the channel is present in all these countries, but has more strength in countries where the structure of finance has traditionally been bank dominated, such as Germany, compared to more market orientated financial systems, such as the US and the UK.

Hall (2001) compares the structure and causes of the 1980s and 1990s recessions in the UK. Business investment levels fell more strongly in the 1990s, despite the cost of finance (proxied by profits divided by the market value of net liabilities) being lower than during the 1980s. However, the financial position of UK corporates was weaker ahead of the 1990s recession – gearing was higher and companies were more dependent on external finance. This implies the credit channel may have played a role in the 1990s recession.

This research suggests a role for the broad credit channel in the UK, but other cross-country studies find the opposite. Fountas and Papagapitos (2001) test the relationship between the external finance premium and real economic activity. If the broad credit channel is present then an increase in the external finance premium will reduce investment and so reduce activity. The results show no evidence for a relationship in the UK and France, but a strong relationship in Germany and Italy.

Finally, de Bondt (1999) analyses the credit channel from the household perspective, by examining the impact of the external finance premium on consumption in the EU. The results suggest a broad credit channel effect on consumption in Germany, Italy and Netherlands, but not in France, the UK and Belgium.

To summarise, the evidence on the credit channel in the UK is not conclusive. Some evidence suggests the broad credit channel may be important in the UK. Because UK firms do not tend to have inter-linked relations with banks, the external finance premium may be high and sensitive to interest rate movements, leading to empirical results which find that UK investment levels are sensitive to cash-flow, net-worth and monetary policy. On the other hand, the greater use of non-bank finance, and the dominance of large banks suggest the bank-lending channel may not be as significant, a conclusion which is supported by the empirical evidence.

Table 4.7: Summary of results of empirical studies of the monetary transmission mechanism (based on Kieler and Saarenheimo, 1998; Guiso et al. 2000).

Percentage point deviation of real GDP from base in year two after a shock to monetary policy ¹	Type	Germany (G)	France (F)	Italy (I)	UK (UK)	Spain (S)	Netherlands (N)	Ranking (G, F, I, UK)	Notes
Single country macro models									
National central banks models (Smets, 1995)	Type 1	-0.4	-0.4	-0.5	-0.9	0	-0.2	G=F=I (<UK)	Fixed exchange rates for D, F, I; endogenous exchange rate for UK
Multi-country macro models									
Fed MCM model (Borio, 1995)	Type 1	-0.7	-0.7	-0.3	-1.2			I<G=F<UK	Endogenous exchange rates
IMF MULTIMOD standard multiplier	Type 2	-0.5			-0.5			G=UK	Endogenous exchange rates
QUEST (Röger and in't Veld, 2002)	Type 1	-0.5	-0.4	-0.4	-0.4			F=I=UK<G	Fixed exchange rates for D, F, I; endogenous exchange rate for UK
Taylor (1993)	Type 2	-0.4	-0.4	-0.4	-0.1			UK<I=G=F	Interest rate increase for one year Endogenous exchange rates
Small structural models									
Britton and Whitley (1997)	Type 1	-0.5	-0.5		-0.3			UK<G=F	Each country estimated separately
Britton and Whitley (1997)	Type 1	-0.4	-0.4		-0.4			G=F=UK	All countries estimated jointly
Reduced form equation									
Dornbusch et al. (1998)	Type 3	-0.5	-0.5	-1.1	-0.5	-0.4		UK=G=F<I	Effect after 8–12 months
Dornbusch et al. (1998)	Type 3	-1.4	-1.5	-2.1	-0.9	-1.5		UK=G=F<I	Effect after 2 years
Structural VARs									
Ramaswamy and Sløk (1998)	Type 4	-0.6	-0.4	-0.5	-0.5	-0.3	-0.6	F<I=UK<G	Baseline model
Barran, Coudert and Mojon (1996)	Type 4	-0.6	-0.4	-0.2	-0.4	-0.4	-0.3	I<F=UK<G	Baseline model (model 1)
Gerlach and Smets (1995)	Type 4	-0.3	-0.2	-0.2	-0.6			F=I<G<UK	I standard deviation shock
Gerlach and Smets (1995)	Type 1	-1.2	-0.6	-0.6	-0.8			F=I<UK<G	
Dedola and Lippi (2000)	n.a.	-2.2	-1.4	-1.1	-1.4			I<UK=F<G	Maximum elasticity to the shock of industrial production
Memo:									
HM Treasury Public Model	Type 1				-0.4				
Bank of England (2000)	Type 1				-0.3				Interest rate increase for one year
NIgEM (HM Treasury)	Type 1				-0.7				
OEF (2002)	Type 1				-0.7				Interest rate increase for one year

¹Where the monetary policy shock lasts for only one year, response of real GDP is for year one after the shock (QUEST, Bank of England and OEF).

Note: Type 1: one percentage point rise in short-term interest rates sustained for at least two years; Type 2: one per cent permanent decrease in money target; Type 3: one percentage point simultaneous permanent increase in short-term interest rates; Type 4: one standard deviation positive interest rate shock.

Source: Adapted from Kieler and Saarenheimo, 1998; Guiso et al. 2000; HM Treasury.

The National Institute Global Econometric Model (NiGEM) is a multi-country structural model. The model has been employed by HM Treasury to simulate the UK and euro area responses to a change in monetary policy under the assumptions of the UK with independent monetary policy and the UK being inside EMU.

The results suggest that the overall impact on output and inflation in response to an increase in interest rates is not significantly different between the UK and the euro area, although there are small differences in the compositional effects on output.

However, although the NiGEM model has recently been developed to include a consumption channel via housing wealth effects for the UK, the scale of the effects are assumed to be small. But analysis in Section 3 suggests the housing sector is an important structural difference between the UK and the euro area economies.

This suggests that the degree of asymmetry between the UK and euro area may be greater than the NiGEM simulations predict, possibly due to higher interest rate sensitivity of demand caused by additional housing-related effects. If these are important, the macroeconomic responses of the UK to shocks inside EMU may be less benign.

5.1 The preceding review of existing research highlights problems with each approach and argues that none of the existing studies are fully focused on the particular question of implications for possible UK entry to EMU. In an attempt to address this, HM Treasury has undertaken its own model-based simulations of the transmission of monetary policy in the UK and the euro area. Because the Treasury Public Model is only used for simulations of the UK economy, the National Institute Global Econometric Model (NiGEM), a multi-country structural model maintained and developed by NIESR¹ has been used.

5.2 Structural macroeconometric models such as NiGEM have the advantage that when being used to investigate how the economy might respond to shocks, the monetary policy response can be controlled directly so different assumptions can be made about the monetary regime being followed. This allows the implications of the UK being inside or outside EMU to be examined more systematically. However, such large-scale common-form macroeconometric models may not fully reflect cross-country differences in structures, a point returned to at the end of this section.

5.3 NiGEM is a multi-country model covering all OECD countries, with the rest of the world in blocs. Each country model is small but complete covering trade in goods and services; foreign assets and liabilities; the government sector; consumption and wealth; a wage-price system embodying a NAIRU (Non Accelerating Inflation Rate of Unemployment); and a production function affecting factor demands, unit costs and prices.

5.4 In the NiGEM model the transmission of monetary policy works through two channels, the exchange rate channel and the interest rate channel. So an increase in interest rates will:

- cause an appreciation in the nominal and real exchange rates (the model has new-Keynesian properties and assumes nominal rigidities in the short term) which will reduce exports. Over time the real exchange rate returns to base as prices adjust; and
- lower consumption through a wealth effect and discourage private investment via an increase in the cost of capital.

¹ National Institute for Economic and Social Research.

5.5 HM Treasury's simulations model the effect of an increase in the short-term interest rate of one percentage point, sustained for two years.² In order to isolate the effects of a monetary policy shock on output through the monetary transmission mechanism, the following scenarios are examined:

- **scenario A:** interest rate shock to the euro area on the assumption that the UK were in EMU; and
- **scenario B:** simultaneous interest rate shock to the UK and the euro area with the UK not participating in EMU.

5.6 Scenario A allows examination of the differences in responses between the UK and the euro area which occur due to different economic structures (in the face of a common interest rate shock and subsequent response). Scenario B highlights any differences which may arise from the UK having an independent monetary policy and the potential ability of the exchange rate to act as a shock absorber outside EMU.

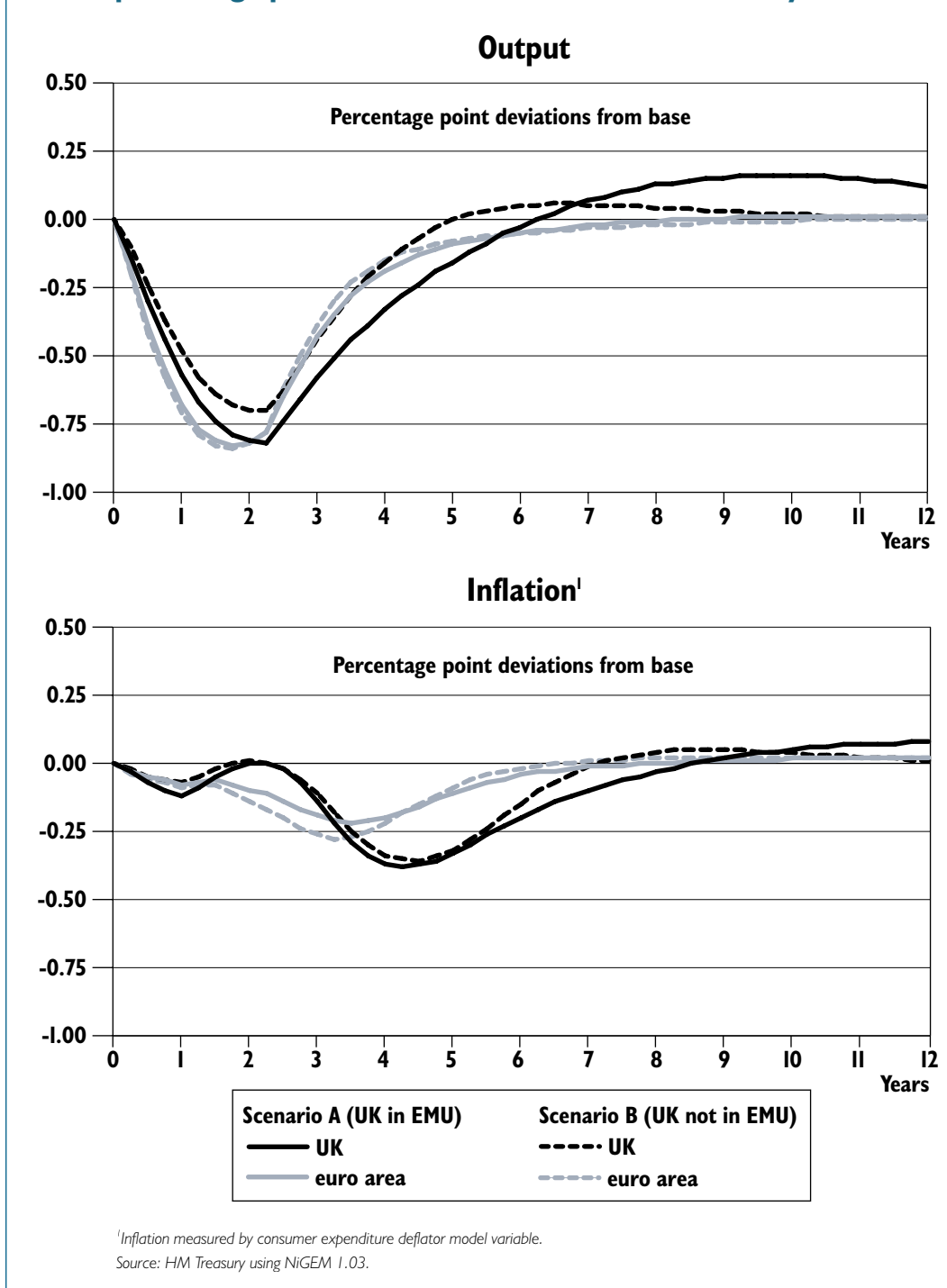
Results of the NiGEM model

5.7 Chart 5.1 shows the output and inflation responses of the UK and euro area as a whole in scenario A (UK in EMU) and scenario B (UK not in EMU). The initial impact on the level of output is very similar for the UK and the euro area in scenario A: a decline compared to base at the end of year 2 of around 0.8 percentage points in the UK and the euro area. The longer run dynamics are slightly different though, with UK output overshooting base. The inflation responses are also similar, although the UK response appears more oscillatory. The largest gap is in year 5 of the simulation where there is a fall in inflation relative to base of 0.4 percentage points in the UK and 0.2 percentage points in the euro area.

5.8 The differences between the 'UK in' and 'UK out' scenarios are also small, excepting when the shock unwinds and the UK experiences less overshooting of output from base when outside EMU. This similarity in output and inflation responses masks some divergence in the route to realising these outcomes.

² The simulations were conducted under forward-looking expectations for wages, long-term interest rates, exchange rates and equity prices, and forward looking consumption. The monetary policy rule used is a Taylor rule and fiscal solvency is assumed for all countries.

Chart 5.1: UK and euro area responses to a temporary one percentage point increase in interest rates for two years



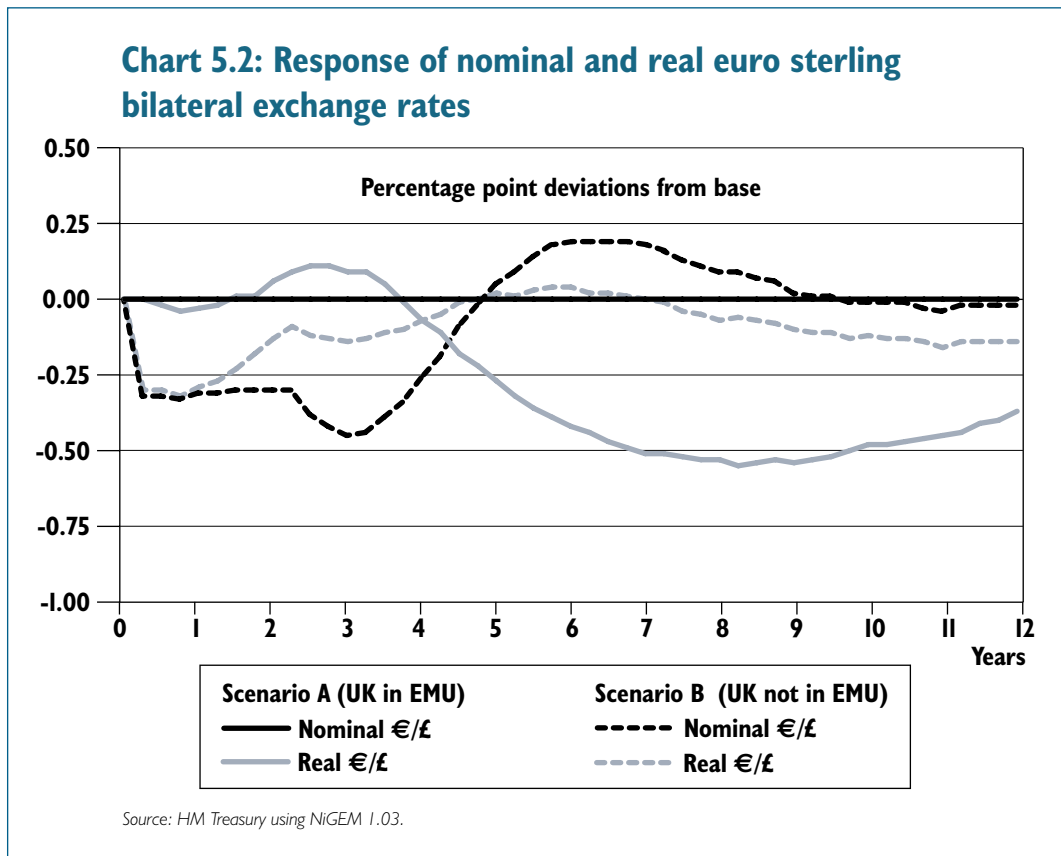
5.9 Chart 5.2 shows the nominal and real euro-sterling exchange rates (€/£) under both scenarios. As identified above, the UK has a slightly stronger negative inflation response than the euro area on average. In both scenarios this has implications for the movements of the nominal and real exchange rates:

- when the UK is outside EMU in scenario B, there is a small differential between the UK and euro area interest rate responses after the initial shock.³ With the model's forward-looking properties this results in an immediate

³ The monetary policy rule used is a Taylor rule and so the more negative response on average of UK inflation results in UK interest rates staying lower than base for longer than euro area rates following the initial shock.

'jump' down of the nominal and real exchange rates in the first year of the shock, depreciating by 0.3 percentage points. The greater UK inflation response shown in Chart 5.1 from year 4 onwards results in the UK price level falling by more than that in the euro area. The nominal exchange rate appreciates to offset this, taking the real exchange rate back to base by year 5;

- when the UK is inside EMU in scenario A, the nominal exchange rate is of course fixed, and so the fall in the relative price level causes the real exchange rate to depreciate from year 4, building to 0.5 percentage points which is sustained in the medium term after seven years.



The ‘Three Bears’ model 5.10 The different way that the UK adjusts to shocks in and out of EMU is analysed further in the EMU study *Modelling shocks and adjustment mechanisms in EMU*. In this study, a stylised model, specifically designed to analyse the issue of UK entry into EMU, is employed to unravel and illustrate the key characteristics of the potential adjustment mechanisms inside EMU.

5.11 For a similar shock to monetary policy as simulated here on NiGEM, the ‘Three Bears’ model⁴ also demonstrates how, outside EMU, the nominal exchange rate plays a role in equilibrating the real exchange rate between the UK and the euro area. Inside EMU, the required adjustment of the real exchange rate is achieved by adjustment in domestic prices rather than by movement of the nominal exchange rate, and as such, the return to equilibrium takes longer.

⁴ The model is intended to capture the macroeconomic interaction between the UK, euro area and the rest of the world and since the three country blocs in the model can broadly be characterised as small, medium-sized and large, it is referred to as the ‘Three Bears’ model.

Contributions to the output response **5.12** Although this result has potential implications for the sectoral balance of effects in the transmission of monetary policy, in practice the NiGEM model suggests that differences are small. Chart 5.3 gives the relative contributions of the components of GDP to the change in output caused by the monetary policy shock. The initial interest rate increase causes a fall in domestic demand, negatively affecting consumption, investment and imports. The effect on net trade overall though is positive because the decline in imports (due to lower domestic demand) is greater than the decline in exports (due to an exchange rate appreciation against external currencies such as the US dollar).

5.13 The negative effects on net trade of the nominal exchange rate appreciation when the UK is outside EMU can be seen in years 5, 6, 7 and 8, but this only amounts to around a 0.2 percentage point change in output from base. This is offset by consumption and investment returning to base more quickly, and so the overall difference in output is small.

5.14 The differences in the responses of GDP components between the UK and the euro area when the UK is assumed to be inside EMU are slightly bigger. Domestic demand falls by more in the UK than the euro area, with private sector investment contributing an extra 0.2 percentage point negative deviation of output from base by year 3, and consumption 0.1 percentage point at most. Weaker UK domestic demand is partially offset by a more positive contribution of net trade. UK exports do not suffer as badly as euro area exports, perhaps because the UK has a larger proportion of non-EMU trade, and this accounts for an extra 0.25 percentage point positive deviation of output from base.

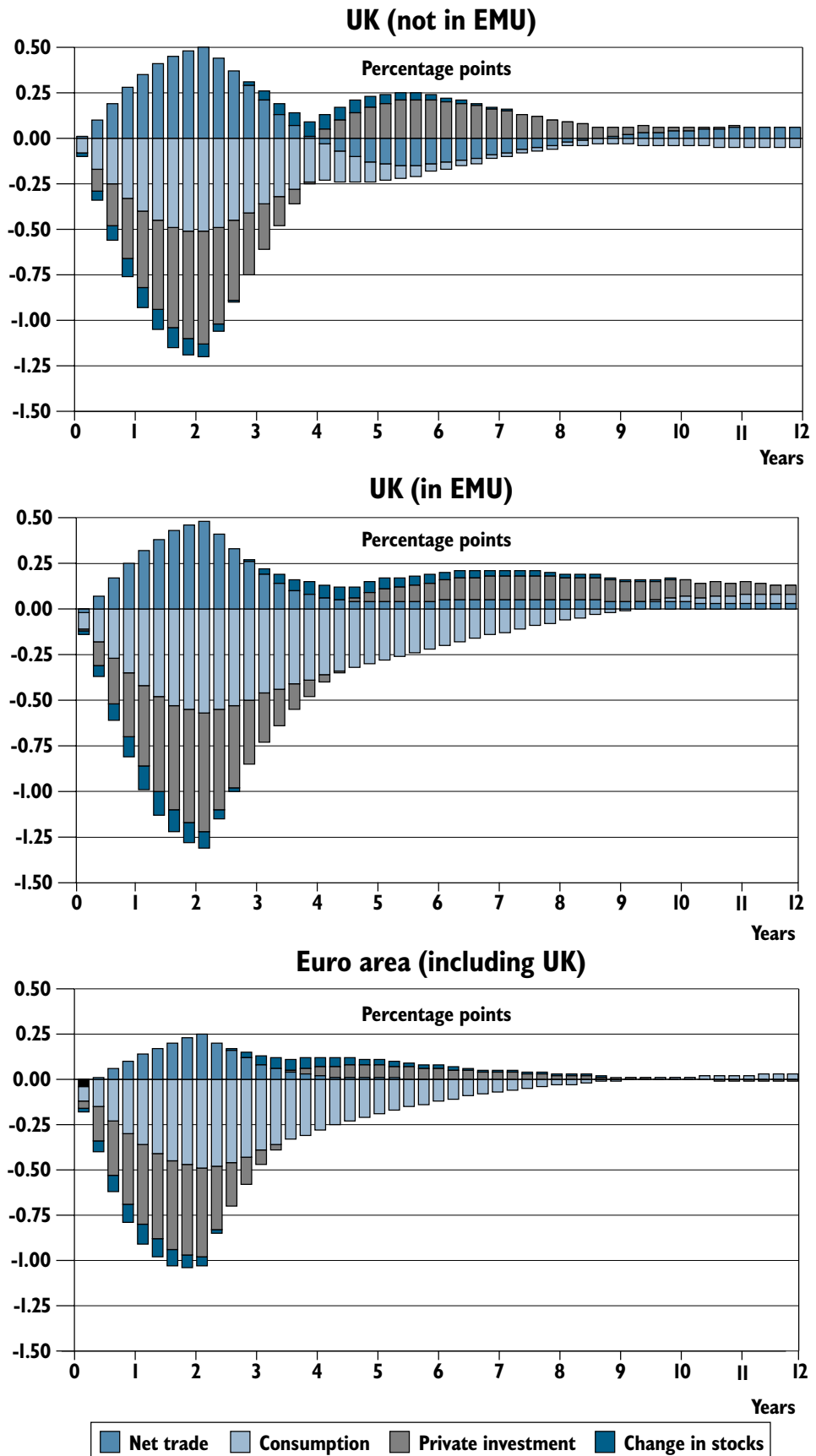
5.15 The implication is that the UK experiences different sectoral and compositional effects to the euro area in the transmission of a monetary policy change. UK exporters fare better than euro area exporters as a whole, but the UK non-traded sector encounters lower domestic demand. However, these differences should not be overplayed as the model predicts that they amount to no more than a 0.2 percentage point change in output.

Conclusions on NiGEM modelling **5.16** These results suggest that the aggregate response to an interest rate change is not significantly different between the UK and the euro area average. However, although the NiGEM model has recently been developed to include a consumption channel via housing wealth effects for the UK, the scale of the effects are assumed to be small, whereas the analysis in Section 3 suggests the housing sector is a potentially important structural difference between the UK and euro area economies. Econometric evidence on short-term interest rate effects on consumption is not as clear cut as evidence of structural differences, but on balance it supports the view that the sensitivity of household spending through the housing market is higher in the UK than elsewhere (as discussed in the EMU study *Housing, consumption and EMU* by HM Treasury). This suggests the degree of asymmetry between the UK and euro area is likely to be greater than the NiGEM simulations predict.

5.17 How significant could this imposed model structure be? In the EMU study *Modelling shocks and adjustment mechanisms in EMU*, sensitivity analysis on the ‘Three Bears’ model is conducted for key structural features. Of particular interest here are the results obtained from varying the direct interest rate sensitivity assumption. Making UK demand more sensitive to interest rates leads to important changes in the UK responses when faced with a symmetric shock (i.e. one that impinges on the UK and the euro area at the same time). Inside EMU, the nominal interest rate response to a given shock is larger than it would be if the UK were operating monetary policy independently. This is because the interest rate response set by the European Central Bank (ECB) is chosen to be appropriate for the euro area as a whole, so needs to be larger given the lower interest rate responsiveness. As a consequence, the UK’s output and inflation responses are more vigorous in the face of shocks inside EMU compared to outside.⁵

⁵ The analysis in the EMU study *Modelling shocks and adjustment mechanisms in EMU* also shows that, in the face of UK-specific (i.e. asymmetric) shocks inside EMU, the higher interest rate elasticity tends to worsen the initially destabilising tendency of UK real interest rates.

Chart 5.3: Contributions to the output response



Source: HM Treasury using NiGEM version 1.03.

The UK monetary transmission mechanism may change if the UK were to enter EMU. Entry to EMU would involve a shift to a regime with no movement in the nominal exchange rate against the euro area, and so an immediate effect would be to reduce the importance of the exchange rate channel.

One reason why the UK is exposed to high levels of mortgage debt at variable rates is its history of macroeconomic instability with high and volatile inflation. In such an environment lenders tend to be unwilling to offer fixed rate mortgages, except at very high rates, to avoid the risk that inflation will erode returns. The UK now has a macroeconomic framework which is delivering stability and low inflation. Since 1999, the ECB has maintained price stability in the euro area. In or out of EMU, the more stable macroeconomic environment might erode differences in the structure of mortgage debt.

Entry to the euro has the potential to facilitate further convergence in mortgage systems by aiding cross-border competition in savings and mortgage products. There are still significant barriers though, and structural factors, such as differences in the responsiveness of housing supply, mean variations in house price trends are also likely to continue in the near future. In most respects, euro area housing markets have remained diverse since the start of EMU.

EMU has promoted the growth and integration of financial markets in the euro area. In turn this may promote convergence of financial structures. Some argue that the euro area will develop capital markets more like those of the UK, due to the rise in institutional investment driven by an increasing provision of private pensions.

6.1 The analysis in Sections 3, 4 and 5 of this paper focused on the current structure of transmission mechanisms. But mechanisms will evolve in response to changes in the macroeconomic environment, and in product, labour and capital markets. This is a particular manifestation of the Lucas critique (Lucas, 1976) that any model estimated under one policy regime is likely to break down when confronted with an alternative regime, in this case EMU. EMU may act as the catalyst for a period of particularly rapid change, which could erode differences in national transmission mechanisms. Some of these changes will be immediate and obvious – the end of nominal exchange rate movements between countries, for example. Others, such as structural reform and the integration of product, labour and capital markets, have the potential to develop over a longer time period, although differences would be unlikely to disappear entirely. Mechanisms vary across US states due to differences in industrial composition and the size mix of firms (see the EMU study *The United States as a monetary union* by HM Treasury, for a detailed analysis of the experiences of the US economy as a monetary union). There are also differences between UK regions and sectors.

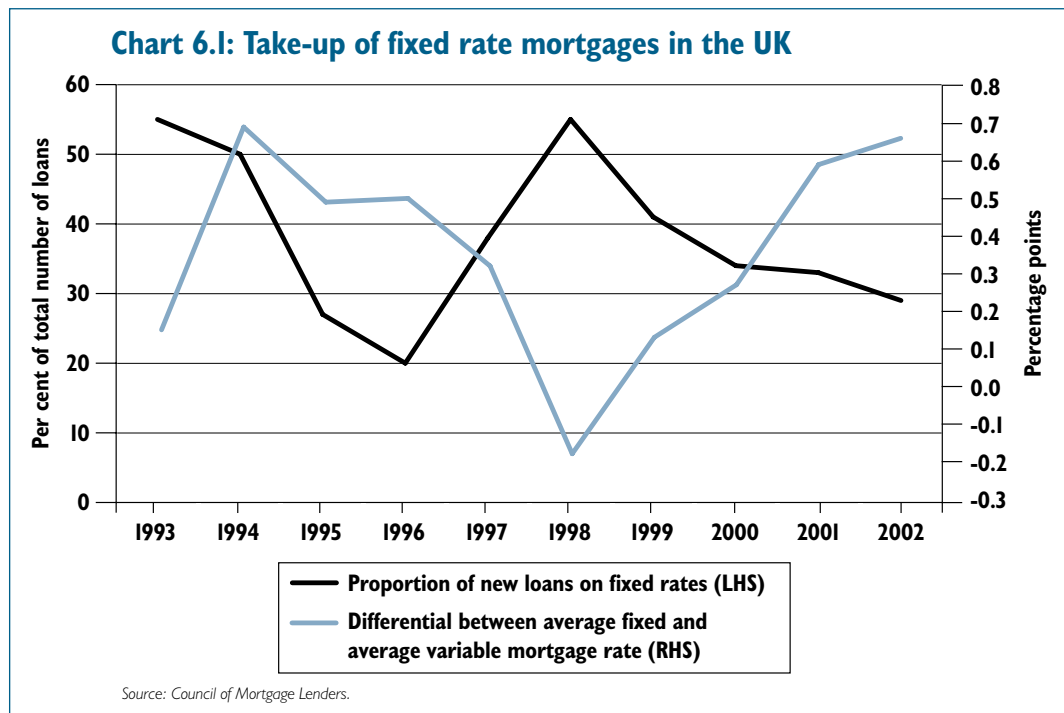
Impact of EMU on the macroeconomic environment

6.2 EMU countries share a common monetary policy and single currency. This immediately changes the impact of the exchange rate channel of monetary policy. The euro area has a lower trade exposure than individual domestic economies, suggesting that the exchange rate channel in the shorter term will be weaker in EMU. Buitert (2000) argues that differences between transmission mechanisms in UK regions and sectors are largely due to differences in the exposure to the exchange rate channel of monetary policy. Being in EMU would limit the scope of exchange rate changes and so joining the euro could reduce asymmetries within the UK relative to the present situation. The Treasury Public Model suggests that the exchange rate channel is important in the UK.

6.3 A common monetary policy may affect the structure of credit. One of the key issues identified in Section 3 is the high level of mortgages at variable rates in the UK. By contrast, many of the euro area countries favour fixed rate mortgages. One reason for this is that the

UK has had a history of macroeconomic instability with high and volatile inflation. In such an environment, lenders tend to be unwilling to offer fixed rate mortgages, except at very high levels, to avoid the risk that inflation will erode the value of returns. The new macroeconomic framework, introduced in 1997, has already had a profound effect in establishing stability and low inflation in the UK, and long-term interest rates suggest that markets expect this to continue in the future. Reduced inflation risk removes one of the barriers to the development of long-term fixed rate products.

6.4 The EMU study *Housing, consumption and EMU* by HM Treasury considers this issue. It finds that the greater stability of inflation and interest rates in the late 1990s has led to periods in which fixed rates mortgages have been attractive to UK borrowers (see Chart 6.1), although the length of fix remains below that of much of the rest of Europe. Evidence from Ireland suggests that the structure of the UK mortgage market would be unlikely to change quickly if the UK were to join EMU. Borrowers in Ireland have continued to switch between fixed and variable rate mortgages depending on which is expected to be cheaper. Chart 6.1 shows that the take up of fixed rate mortgages in the UK is closely related to the differential between fixed and variable interest rates.



6.5 EMU is likely to lead to convergence of nominal mortgage interest rates, an issue which is also considered in the EMU study *Housing, consumption and EMU*. The creation of the euro has established a common benchmark, the official ECB interest rate, for mortgage rates and savings products across euro area countries, and there is evidence from the euro area of significant convergence of nominal mortgage rates since 1999. However, a single monetary policy will not lead to exactly equal mortgage rates across countries, due to differences in the type of mortgage product offered in different countries. Real mortgage interest rates will continue to vary due to differences in national inflation in EMU.

6.6 EMU also has the potential to accelerate the pace toward a single EU mortgage market, which could remove some of these differences. However, there are serious impediments to such developments at this early stage. Differences in market structures, regulation, interest rate terms and risks of default are likely to act as a barrier to the development of cross-border competition. To date, there is little evidence of mortgage market convergence in the euro area. Even if mortgage

markets converged, differences in house price trends are likely to continue within EMU, as other factors that determine housing demand and supply, such as planning policies, are domestically determined. The *Housing, consumption and EMU* study finds that since the introduction of the euro, cross-country differences in house price inflation across euro area countries have fallen, but in all other respects housing markets in the euro area have remained diverse.

Impact of EMU on financial integration

6.7 Financial market structures vary across euro area countries. However, such differences may decrease in EMU. Arnold and de Vries (2000) suggest that characteristics of the financial structure in euro area economies are endogenously determined by the monetary regime in place. They use a simple model to show that capital market structure is correlated with past inflation and inflation uncertainty. They argue that this suggests that with a common monetary policy, market structure will converge.

6.8 The integration of financial markets between euro area countries is considered in the EMU studies *The location of financial activity and the euro* and *EMU and the cost of capital* by HM Treasury. In summary, the evidence so far indicates that the euro has had a considerable impact on financial markets – turnover has increased in many sectors, cross-border activity is rising and market participants' costs are falling. However, full integration is still some way off: trading and settlement systems are generally fragmented; many regulatory constraints on full integration remain in place; and market participants with local expertise still tend to have a home bias.

6.9 One immediate impact of the euro is that the pass-through from official rates to market wholesale rates is now virtually identical across the euro area. This is due to the combination of the ECB's decentralised open market operations, and the successful launch of an integrated high-value payments system (TARGET), which has resulted in the convergence of short-term interest rates across the euro area. This indicates that liquidity is successfully flowing across national borders in response to imbalances in liquidity needs. As discussed in Section 3, there is also evidence that differences in pass-through of official rate changes to retail market rates have narrowed across the euro area, and that adjustment overall has become faster since January 1999. This could be attributed to an increase in competition in the euro area banking market.

6.10 What does the growth and integration of capital markets mean for the monetary transmission mechanism? Section 3 highlighted some of the differences in corporate finance structures which could contribute to asymmetries in the transmission mechanism. Davis (1999) argues that financial market integration in EMU may promote the development of UK style capital markets across the euro area. This view is supported by Professors Giavazzi and Favero in their contribution to the EMU study *Submissions on EMU from leading academics*. Their tentative conclusions are that:

“historical differences in financial systems have been substantially eroded in the last decade. Within the Euro area, the adoption of market instruments in the financing of firms has been most marked in Germany, France and Finland, who have moved towards the practices prevalent in the UK and the US. The UK financial structure, moreover, is becoming more like that of EMU countries, and has moved further in that direction even during the short time since the launch of the Euro, though differences persist within the Euro area itself.”

Pensions 6.11 An important additional factor is the rise in institutional investment in the euro area, which is being driven by an increasing need for the provision of private pensions. This trend has been occurring for several years: compared to 1980, assets held by institutional investors in Germany had almost doubled by 1997, and had more than trebled in France, albeit from low bases. Institutional investors tend to hold a greater proportion of their assets in equities and other securitised assets.

Empirical studies of convergence in EMU **6.12** Ciccarelli and Rebucci (2002) look for evidence of transmission mechanism convergence in the euro area countries. They find that over the medium term there are only very small differences in the impact of monetary policy among the large euro area countries; they also find that mechanisms changed over the late 1990s in the run up to EMU, but that they did not become more homogeneous. Because earlier studies have found greater heterogeneity based on 1980s data, they speculate that a period of convergence may have taken place in the first half of the 1990s. Clausen and Hayo (2002) and Mihov (2001) undertake similar analysis but find no evidence for a structural break in the transmission mechanisms of euro area countries ahead of the start of EMU. These results may not be surprising, given that convergence in transmission mechanisms may well take longer than a few years to become apparent.

7.1 Structural analysis suggests a number of factors that may make the UK more sensitive to monetary policy. In particular, the speed and extent of the pass-through of monetary policy from official interest rates to bank lending rates; the potentially greater impact of changes in housing wealth on UK consumption; the higher exposure to mortgage debt at variable rates; and the greater exposure to interest-sensitive assets such as equity.

7.2 However, there are also factors which may make the UK less sensitive to monetary policy. UK production is relatively service intensive, nominal wage rigidity is relatively low and the UK may have a lower exposure to the bank-lending channel.

7.3 Overall, this study finds that there is more evidence for structural factors that will increase the strength of the transmission mechanism in the UK relative to other countries. But it is difficult to weigh up in aggregate the impact of structural factors so as to identify the overall relative strength of the transmission mechanism.

7.4 Possible evidence on the overall impact of monetary policy is provided by empirical studies. A study by Smets (1995) compares the cross-country responses to a monetary policy shock using the different country-specific macroeconomic models maintained by national central banks. This study stands out as suggesting that the UK has a significantly stronger output response than in euro area countries; although the Treasury Public Model estimates that the UK response to the same shock is broadly in line with the Smets results for the euro area countries. The Bank of England (2000) also estimates a lower UK output response than in Smets (1995).

7.5 A different modelling approach is to apply the same theoretical macroeconomic or structural model across countries. The UK does not appear to be an obvious outlier when looking across the results of all these studies. HM Treasury simulations on the National Institute Global Econometric Model (NiGEM) show no significant difference between the overall impact on output and inflation between the UK and the euro area.

7.6 However there are technical issues with each of these approaches. The Smets (1995) approach uses different models for each country, so variations in responses may be due to theoretical differences in model specification. On the other hand, imposing a common theoretical model across countries means that real structural differences, such as housing in the UK, are not fully captured. For example, although the NiGEM model has recently been developed to include a consumption channel via housing wealth effects for the UK, the scale of the effects are assumed to be small. Because the housing sector is an important structural difference between the UK and euro area economies, the degree of asymmetry between the UK and euro area is likely to be greater than the NiGEM simulations predict.

7.7 Much of the external analysis of these issues is static – examining current differences between the UK and the euro area. But the influence of EMU membership and other developments could change the structure of the transmission mechanism. Two areas in particular could be affected: the macroeconomic environment and the structure of financial markets.

7.8 Overall, certain features of the UK economy, in particular the household sector's large stock of mortgages held at variable rates and other aspects of the housing market, suggest the UK monetary transmission mechanism may be stronger than that of the euro area. Other features of the economy may act to reduce the strength of the transmission mechanism in relation to euro area countries. However, the analysis in this study suggests that the former group of features are dominant. Empirical model-based studies do not demonstrate consistently that the UK transmission mechanism stands out from others. But these models do not fully reflect the structural differences which would be relevant in practice. That said, at least some of any differences which do exist may erode over time, particularly if the UK were to enter EMU on the basis of sustainable convergence between the UK and the euro area. These issues are considered further in the convergence test – the first of the Government's five economic tests for EMU entry.

REFERENCES

- Angeloni, I., Kashyap, A., Mojon B., and Terlizzese, D. (2002) *Monetary Transmission in the Euro Area*. ECB Working Paper No. 114.
- Arnold, I.J.M., and de Vries, C.G. (2000) 'Endogenous Financial Structure and the Transmission of ECB Policy', in J. von Hagen and C.J. Waller (eds), *Regional Aspects of Monetary Policy in Europe*. London: Kluwer Academic.
- Ashworth, P., and Davis, P. (2001) 'Some Evidence on Financial Factors in the Determination of Aggregate Business Investment for the G7 Countries'. NIESR Discussion Paper No. 187.
- Ashworth, P., Hubert, F., Pain, N., and Riley, R. (2001) 'UK Fixed Capital Formation: Determinants and Constraints; NIESR Paper prepared for the DTI and CBI/TUC Working Party on Investment.
- Balls, E., and O'Donnell, G. (eds) (2002) *Reforming Britain's Economic and Financial Policy*. HM Treasury. Palgrave.
- Bank of England (1999) *Economic models at the Bank of England*, available at <www.bankofengland.co.uk>
- Bank of England (2000) *Economic models at the Bank of England, September 2000 update*, available at <www.bankofengland.co.uk>
- Bank of England (2001) *Finance for Small Firms – 8th Report*. London: Bank of England, March.
- Bank of England (2002) *Monetary and Financial Statistics*. London: Bank of England, March (Table C3.3).
- Barran, E., Coudert V., and Mojon, B. (1996) 'The Transmission of Monetary Policy in the European Countries.' CEPII Working Paper No. 96-03.
- Bean, C., Larsen J., and Nikolov, K. (2002) 'Financial Frictions and The Monetary Policy Mechanism: Theory, Evidence and Policy Implications'. ECB Working Paper No. 113.
- Bond, S., Elston, J., Mairesse, J., and Mulkey, B. (1997) 'Financial Factors and Investment in Belgium, France, Germany and the United Kingdom: A Comparison using Company Panel Data'. NBER Working Paper No. 5900.
- Bond, S., Harhoff, D., and Van Reenan, J. (1999) 'Investment, R&D and Financial Constraints in Britain and Germany'. IFS Working Paper No. 99/5.
- Boone, L., Giorno, C., and Richardson, P. (1998) 'Stock Market Fluctuations and Consumption Behaviour: Some Recent Evidence'. OECD Working Paper No. 208.
- Borio, C.E.V. (1995) 'The Structure of Credit to the Non-Government Sector and the Transmission Mechanism of Monetary Policy: A Cross Country Comparison'. BIS Working Paper No. 24.
- Borio, C.E.V., and Fritz, W. (1995) 'The Response of Short-Term Bank Lending Rates to Policy Rates: A Cross Country Perspective'. BIS Working Paper No. 27.
- Britton, E., and Whitley, J. (1997) 'Comparing the Monetary Transmission Mechanism in France, Germany and United Kingdom: Some Issues and Results', *Bank of England Quarterly Bulletin* 37(2), pp.152-162.
- Buiter, W. (2000) 'Optimal Currency Areas: Why Does the Exchange Rate Regime Matter?'. *Scottish Journal of Political Economy* 47(3), pp. 213-250.

- Bush, J. (ed) (2001) *The Economic Case Against the Euro*. London: New Europe.
- Byrne, J.P., and Davis, E.P. (2001) 'Dissaggregate Wealth and Aggregate Consumption: an Investigation of Empirical Relationships for the G7.' NIESR Discussion Paper No. 180.
- Byrne, J.P., and Davis, E.P. (2002) 'A Comparison of Balance Sheet Structures in Major EU countries', *National Institute Economic Review* 180, pp.83-95.
- Campa, J., and Goldberg, L. (2002) 'Exchange Rate Pass-Through into Import Prices: A Macro or Micro Phenomenon?'. Federal Reserve Bank of New York Staff Reports No. 149.
- Campa, J., and Minguez, J. (2002) 'Differences in Exchange Rate Pass-Through in the Euro Area'. Banco De Espana Working Paper No. 0219.
- Case, K.E., Quigley, J.M., and Shiller, R.J. (2002) 'Comparing Wealth Effects: The Stock Market Versus the Housing Market'. Cowles Foundation Discussion Paper No. 1335.
- Cassola, N., and Morana, C. (2002) 'Monetary Policy and the Stock Market in the Euro Area'. ECB Working Paper No. 119.
- Cecchetti, S.G. (1999) 'Legal Structure, Financial Structure, and the Monetary Policy Transmission Mechanism'. NBER Working Paper No. 7151.
- Ciccarelli, M., and Rebucci, A. (2002) 'The Transmission Mechanism of European Monetary Policy: Is there Heterogeneity? Is it Changing Over Time?'. IMF Working Paper No. 02/54.
- Clausen, V., and Hayo, B. (2002) 'Asymmetric Monetary Policy Effects in EMU'. Centre for European Integration Studies Working Paper No. 4.
- Clements, B., Kontolemis, Z., and Levy J. (2001) 'Monetary Policy Under EMU: Differences in the Transmission Mechanism?' IMF Working Paper No. 01/02.
- Corbett, J., and Jenkinson, T. (1997) 'How is Investment Financed? A Study of Germany, Japan, the United Kingdom and the United States'. *Manchester School Supplement* 65(0).
- Cottarelli, C., and Kourelis, A. (1994) 'Financial Structure, Bank Lending Rates, and the Transmission Mechanism of Monetary Policy', *IMF Staff Papers* 41(4), pp. 587-623.
- Davis, E.P. (1999) 'Institutionalisation and EMU: Implications for European Financial Markets', *International Finance* 2(1), pp. 33-61.
- De Bondt, G. (1999) 'Credit Channels and Consumption in Europe: Empirical Evidence'. BIS Working Paper No. 69.
- De Bondt, G. (2002) 'Retail Bank Interest Rate Pass-Through: New Evidence at the Euro Area Level'. ECB Working Paper No. 136.
- Dedola, L., and Lippi, F. (2000) 'The Monetary Transmission Mechanism: Evidence from the Industries of Five OECD Countries'. Banca d'Italia Temi di Discussione No. 389.
- Dhar, S.K., Fisher, P.G., Holland, A.M. and Pain, D.L. (1995) 'Interest Rate Effects in the Bank of England Medium-Term Forecasting Model', *Financial Structures and the Monetary Policy Transmission Mechanism*, Bank for International Settlements, Basel.
- Dornbusch, R., Favero, C.A., and Giavazzi, F. (1998) 'Immediate Challenges for the ECB – Issues in Formulating a Single Monetary Policy', in Begg *et al.* (eds), *EMU: Prospects and Challenges for the Euro special issue of Economic Policy: A European Forum*. Blackwell.

- Ehrmann, M. (2000) 'Comparing Monetary Policy Transmission Across European Countries', *Weltwirtschaftliches Archiv, Review of World Economics* 136(1) pp. 58-83.
- Ehrmann, M., Gambacorta, L., Martinez-Pages, J., Sevestre, P., and Worms, A. (2001) 'Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area'. ECB Working Paper No. 105.
- European Central Bank (1999) *Possible Effects of EMU on the EU Banking Systems in the Medium to Long Term*. Frankfurt: ECB.
- European Central Bank (2002) *ECB Monthly Bulletin*. Frankfurt: ECB, October.
- European Commission (2002) *The EU Economy 2002 Review*. Brussels.
- European Commission, DG Enterprise (2002) 'SMEs in Europe, Including a First Glance at EU Candidate Countries', Observatory of European SMEs, Report No. 2.
<http://europa.eu.int/comm/enterprise/enterprise_policy/analysis/doc/smes_observatory_2002_report2_en.pdf>
- Fountas, S., and Papagapitos, A. (2001) 'The Monetary Transmission Mechanism: Evidence and Implications for European Monetary Union', *Economics Letters* 70(3), pp. 397-404.
- Gerlach, S., and Smets, F. (1995) 'The Monetary Transmission Mechanism: Evidence from the G7 Countries', in *Financial Structure and the Monetary Transmission Mechanism*, Bank for International Settlements, Basel.
- Greenspan, A. (2001) Opening remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 31.
- Guiso, L., Kashyap, A.K., Panetta, F., and Terlizzese, D. (2000) 'Will a Common European Monetary Policy Have Asymmetric Effects?'. Banca d'Italia Temi di Discussione No. 384.
- Hall, S. (2001) 'Financial Effects on Corporate Investment in UK Business Cycles', *Bank of England Quarterly Bulletin* 41(4) (Winter), pp. 449-459.
- HM Treasury (1997) *An Assessment of the Five Economic Tests*. London.
- Hooper, P., Johnson, K., and Marquez, J. (1998) 'Trade Elasticities for G-7 Countries'. Board of Governors of the Federal Reserve System, International Finance Discussion Papers No. 609.
- International Monetary Fund (2002) *World Economic Outlook*. Washington, DC: IMF, April.
- Issing, O., Gaspar, V., Angeloni, I., and Tristani, O. (2001) *Monetary Policy in the Euro Area*. Cambridge: Cambridge University Press.
- Kashyap, A.K., and Stein, J.C. (1997) 'The Role of Banks in Monetary Policy: A Survey with Implications for the European Monetary Union', *Federal Reserve Bank of Chicago Economic Perspectives* 21(5), pp. 2-18.
- Kieler, M., and Saarenheimo, T. (1998) 'Differences in Monetary Policy Transmission? A Case Not Closed'. European Commission Economic Papers No. 132.
- Krugman, P.R. (1986) 'Pricing to Market when the Exchange Rate Changes'. NBER Working Paper No. 1926.
- Layard, R., Buiter, W., Huhne, C., Hutton, W., Kenen, P., and Turner, A. (2002) *Why Britain Should Join the Euro*. London: Centurion Press.

- López-Iturriaga, F.J. (2000) 'More on the Credit Channel of Monetary Policy Transmission: An International Perspective', *Applied Financial Economics* 10(4), pp. 423-434.
- Lucas, R.E. (1976) 'Econometric Policy Evaluation: A Critique', in K. Brunner and A.H. Meltzer (eds) *The Phillips Curve and Labour Markets*. North Holland.
- Maclennan, D., Muellbauer, J., and Stephens, M. (2000) *Asymmetries in Housing and Financial Markets and EMU*. Updated version of paper published in *Oxford Review of Economic Policy*, 14 (3) Autumn 1998.
- Masson., P., Symansky, S., and Meredith, G. (1990) 'MULTIMOD Mark II: A Revised and Extended Model'. IMF Occasional Paper No. 71.
- McCarthy, J. (2000) 'Pass-through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies'. Federal Reserve Bank of New York Working Paper No. 111.
- Mihov, I. (2001) 'Monetary Policy Implementation and Transmission in the European Monetary Union', *Economic Policy: A European Forum* 33, pp. 371-406.
- Mishkin, F.S. (2001) 'The Transmission Mechanism and the Role of Asset Prices in Monetary Policy'. NBER Working Paper No. 8617.
- Mojon, B. (2000) 'Financial Structure and the Interest Channel of the ECB Monetary Policy'. ECB Working Paper No. 40.
- Monetary Policy Committee (2001) *The Transmission Mechanism of Monetary Policy*. Note produced by the Monetary Policy Committee, available at <www.bankofengland.co.uk>
- Norman, B., Sebastia-Barriel, M., and Weeken, O. (2002) 'Equity Wealth and Consumption – the Experience of Germany, France and Italy in an International Context', *Bank of England Quarterly Bulletin* 42(1) (Spring), pp. 78-85.
- Obstfeld, M. (2002) 'Inflation-Targetting, Exchange Rate Pass-Through and Volatility', *American Economic Review* 92(2), pp. 102-107.
- Oxford Economic Forecasting (2002) 'The impact of shocks on the UK economy in and out of EMU', *Economic Outlook*, July 2002.
- Oxford Economic Forecasting (2003) 'The housing market and the monetary transmission mechanism in the UK, in and out of EMU' Paper prepared for the no campaign, February 2003.
- Pagan, A. (2003) 'Report on modelling and forecasting at the Bank of England', available at <www.bankofengland.co.uk>
- Poterba, J. (2000) 'Stock Market Wealth and Consumption', *Journal of Economic Perspectives* 14(2) (Spring), pp. 99-118.
- Ramaswamy, R., and Sløk, T. (1998) 'The Real Effects of Monetary Policy in the European Union: What are the Differences?', *IMF Staff Papers* 45(2), pp. 374-396.
- Rigobon, R., and Sack, B. (2002) 'The Impact of Monetary Policy on Asset Prices'. NBER Working Paper No. 8794.
- Röger, W., and in't Veld, J. (2002) 'Some Selected Simulation Experiments with the European Commission's QUEST model'. European Commission, Economic Paper No. 178.
- Senhadji, A.S., and Montenegro, C.E. (1999) 'Time Series Analysis of Export Demand Equations: A Cross-Country Analysis', *IMF Staff Papers* 46(3), pp. 259-273.

Smets, F. (1995) 'Central Bank Macroeconometric Models and the Monetary Policy Transmission Mechanism' in *Financial Structure and the Monetary Policy Transmission Mechanism*. Bank for International Settlements, Basel.

Taylor, J.B. (1993) *Macroeconomic Policy in a World Economy – From Econometric Design to Practical Operation*. WW Norton and Company.

Taylor, J. (2000) 'Low Inflation, Pass-Through and the Pricing Power of Firms', *European Economic Review* 44(7), pp. 1389-1408.

Taylor, M.P. (1995) 'The Economics of Exchange Rates', *Journal of Economic Literature* 33(1) (March), pp. 13-47.

Thaler, R.H. (1990) 'Anomalies: Saving, Fungibility, and Mental Accounts', *Journal of Economic Perspectives* 4, pp. 193-206.

