

Modelling the transition to EMU

EMU study by Dr Peter Westaway



HM TREASURY



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*This study has been prepared by Dr Peter Westaway
to inform the assessment of the five economic tests*

This study has been prepared by Dr Peter Westaway, while on secondment to HM Treasury from the Bank of England. Dr Westaway would like to acknowledge technical assistance from Dr Karen Dury of the Bank of England on the models included in this study. All content, conclusions, errors and omissions in this study are, however, the responsibility of HM Treasury alone and do not in any way reflect the position of the Bank of England.

This is one of a set of detailed studies accompanying HM Treasury's assessment of the five economic tests. The tests provide the framework for analysing the UK Government's decision on membership of Economic and Monetary Union (EMU). The studies have been undertaken and commissioned by the Treasury.

These studies and the five economic tests assessment are available on the Treasury website at:

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EXECUTIVE SUMMARY

Aim of the study 1 This study is intended to inform discussion of the possible transition costs that would be incurred in the event of the UK economy entering EMU. More generally, the study aims to provide a conceptual framework for thinking about this type of regime change. It is based on two complementary modelling exercises, one stylised, another empirically based but still inevitably adopting a simplified version of the real world. These are designed to capture the key elements of the analysis of transition. And they are intended to inform the choices of policymakers in assessing the case for UK membership. This study is not concerned with microeconomic costs associated with the changeover to using euro notes and coins. And it does not examine the change in the ability of the UK economy to respond to ongoing shocks inside EMU compared to outside.

Defining transition costs 2 Transition costs are defined as those macroeconomic costs that arise for the UK economy in the process of moving from the current monetary regime of inflation targeting to a different regime where the UK is a member of EMU. They arise for two main reasons. Either it may be costly for the UK economy to adjust to the new medium-term equilibrium that EMU may imply. Or, even if EMU entry does not imply a changed equilibrium, the UK may already be in the process of responding to a shock and it may be more costly to adjust inside EMU.

Transition costs in the overall cost-benefit analysis of EMU 3 The study explains how ‘transition costs’ to the economy fit into the wider cost-benefit analysis of EMU. The key points are as follows:

- transition costs potentially form an important element of the overall cost-benefit calculus, and so should have a bearing on any decision about whether and when to join EMU;
- the neutral assumption would be that these costs are relatively short-lived, since in the long run it is typically assumed that the real configuration of the economy, and in particular the real exchange rate, will be determined by fundamental factors, in or out of EMU. But transitional influences would tend to get larger if the economy were subject to ‘hysteresis effects’, whereby large movements away from disequilibrium would have long-lasting or even permanent effects on the economy; and
- unlike most ongoing factors affecting the cost-benefit calculation, transition costs could be influenced by policy decisions regarding both the terms of entry and the timing.

4 If the UK were to enter EMU, the aim of policymakers would be to minimise the transition costs. The set of policy choices that would need to be taken to achieve this is referred to here as the ‘transition strategy’. The choice of euro-sterling conversion rate on entry is an important element of this, though not the only one.

Modelling a transition strategy 5 From the perspective of trying to model the process, this study provides a checklist of the decisions that would need to be taken in order to manage a possible transition into EMU most effectively for the UK economy. For the purpose of this study, the main choices defining the ‘transition strategy’ are as follows:

- an entry date;
- a nominal entry rate; and
- for cases involving a delay between announcing a decision to enter EMU and the intended date of entry, a well defined monetary policy strategy for the transition phase, possibly supplemented by a tailored approach to fiscal policy which would help to minimise the transition costs.

A two-pronged modelling approach 6 In analysing the transition problem, the study adopts a modelling approach that has two main stages:

- first, a stylised model is used to explain the conceptual considerations necessary in designing a transition strategy, and the analytics of EMU entry under alternative assumptions. The analysis begins with the simplest possible case, and then gradually builds on this through successive steps of making the problem more realistic and complicated; and
- second, the principles examined in the context of the stylised model are applied to an empirically based macroeconometric model. This allows an explicit ‘what if’ analysis under different assumptions regarding the terms and timing of any entry to EMU. And it shows how the predicted outcomes of different strategies are affected by different assumptions about the evolution of the fundamentals of the economy.

Lessons of stylised modelling approach 7 The stylised modelling exercise suggests that three considerations would be important in managing the transition were the UK to join EMU:

- the extent to which the UK’s prevailing inflation target was consistent with the ECB’s price stability strategy;
- the extent to which the *ex-ante* bilateral UK-euro area real exchange rate might deviate from medium-term equilibrium at the time of entry (where crucially *ex-ante* means the exchange rate that would have prevailed in the case where the UK stays outside EMU); and
- the extent to which wage and price stickiness would prevent the UK economy from immediately adjusting fully (and costlessly) to the new monetary regime.

8 In terms of the analytics of this study, it is shown that if there were complete cyclical convergence between the UK and euro area, if the real exchange rate were at its equilibrium level, and if target inflation were the same inside or outside EMU, then the transition to EMU would be costless. Neither inflation nor output would need to adjust as a direct consequence of locking the nominal exchange rate.

Implications of differing inflation targets **9** If the implicit inflation target inside EMU were for some reasons expected to be lower than outside, then the transition would only be costless under conditions of complete wage and price flexibility. In more realistic situations where inflation displays inertia, the transition to EMU membership would involve short-term inflation and output costs. The analysis suggests that it would probably be less costly in terms of inflation and output volatility to bring about the required disinflation *in advance* of entering EMU.

Implications of ex-ante disequilibrium in exchange rate **10** The implications of EMU entry when the *ex-ante* exchange rate is away from long-run equilibrium are more complicated. In principle, it would be possible to choose the entry rate so as to relocate the exchange rate back at its long-run equilibrium. But the analysis suggests that this may not necessarily be appropriate. Instead, the optimal choice of entry rate would significantly depend on why the exchange rate was away from its equilibrium in the first place:

- if the disequilibrium were caused by a financial market bubble or risk premium shock associated with sterling, this would by definition disappear on EMU entry. This would point to a strategy of choosing a rate at or near the long-run equilibrium rate; but
- if the disequilibrium were caused by a real demand or supply shock temporarily driving the real exchange rate away from its long-run equilibrium over the short to medium term, then a choice of entry rate that attempted to override this might not be successful. The warranted short-run real exchange rate would tend to reassert itself via changes in UK inflation relative to the euro area.

11 One policy implication from this part of the analysis is that there is not a straightforward mapping between empirical estimates of the long-run equilibrium exchange rate (as described in the EMU study by Professor Simon Wren-Lewis *Estimates of equilibrium exchange rates for sterling against the euro*) and the ideal entry rate. Moreover in practice, quite apart from the problems of forming a reliable judgement on the extent of disequilibrium in the real exchange rate, it may be hard to distinguish between the contribution of real and financial shocks. This adds to the risks surrounding the development of a transition strategy.

An empirically-based modelling approach **12** The practical problem facing policymakers designing a transition strategy is how to apply the principles underpinning the stylised analysis. This is facilitated in this study by using an empirically estimated macroeconometric model, the National Institute Global Econometric Model (NiGEM). This is designed to capture how the UK economy interacts with the euro area economy and the rest of the world in response to various shocks. It can be used to construct alternative scenarios under different assumptions about the terms and timing of any UK entry into EMU. And these scenarios can be compared with the baseline case of maintaining an independent monetary policy.

Empirical prerequisites **13** Following on from the stylised analysis, two sets of simplifying assumptions in the empirically based modelling analysis are important in influencing the results.

14 The long-run level of short-term interest rates is assumed to be equal in the UK and the euro area whether the UK is in EMU or not. This relies on two assumptions. First, that the UK's RPIX inflation target of 2.5 per cent is roughly equivalent to 2 per cent on the HICP definition, which is in line with the outturns seen in the euro area since the start of EMU. And second, that real interest rates in the UK and the euro area will be equal in capital markets where capital is highly mobile.

15 Regarding the expected equilibrium level of the euro-sterling real exchange rate, two alternative baseline scenarios are considered:

- first, it is assumed that the real exchange rate is sustainable around levels prevailing at the assumed time of EMU entry on the model; and
- second, an alternative assumption is adopted where the medium-term equilibrium exchange rate is assumed to be much lower than prevailing levels.

16 No attempt is made to evaluate these alternative assumptions in this study. This is left to the assessment of the five tests itself. But the judgment is important because, as this study demonstrates, different assumptions about the expected behaviour of the real exchange rate outside EMU have an important bearing on the predicted implications of any given transition strategy.

Scenario analysis 17 Within this empirical framework, a range of alternative scenarios is examined. In doing so, the study deliberately abstracts from the details of the Government's actual policy on EMU, for example relating to the requirement that a Government decision to join is affirmed by Parliament and by the British people in a referendum. This is consistent with the explicit focus of this study on modelling various transition scenarios rather than trying to replicate the real world circumstances of policy.

18 The stylised assumption is made that any decision to enter EMU would take place in 2003Q3. EMU entry itself would take place as soon as practically feasible thereafter, here assumed to be in 2005Q1, although the implications of considering a later entry date are also drawn out.

19 Two alternative entry rates are considered:

- 1.50 €-£, a nominal rate consistent with that expected to prevail on the first baseline scenario at the time when EMU entry would be envisaged, i.e. in 2005Q1; and
- 1.37 €-£, a rate consistent with the estimate of the medium-term equilibrium exchange rate underpinning the second baseline scenario, as put forward in the EMU study *Estimates of equilibrium exchange rates for sterling against the euro* by Professor Simon Wren-Lewis.

20 Under these modelling assumptions, a range of monetary-fiscal transition strategies is described:

- one option involves immediate convergence of the nominal exchange rate to the required entry rate. This implies that UK interest rates should also immediately move to euro area levels, given the maintained assumption of uncovered interest parity (UIP) in financial markets, whereby the exchange rate moves to compensate for any interest rate differential; and
- an alternative option involves a gradual convergence to the required entry rate. Given UIP, this would allow UK interest rates to be held higher than ECB rates until the point of entry.

21 The **fiscal policy** element of the transition strategy is assumed to entail:

- either simply allowing the automatic stabilisers to operate ‘passively’; or
- alternatively, allowing fiscal policy to be set in a ‘discretionary’ manner to mitigate any inflationary or deflationary aspects of the transition. Active fiscal policy is assumed to involve either changes in government spending on goods and services or changes in personal income tax rates. The analysis sets to one side the practical problems of operating discretionary fiscal policy. Such issues are considered in the EMU study *Fiscal stabilisation and EMU* by HM Treasury.

Conclusions... **22** Inevitably, the predictions from any empirically estimated model are subject to considerable uncertainty, so the precise results need to be treated with caution. Nevertheless, to the extent that the scenario analysis provides a particular illustration of the more general principles explained in the stylised analysis, a number of potentially important policy implications seem to emerge which are for the assessment of the five tests to address.

...under assumption that real exchange rate level is sustainable... **23** Under the assumption that the current strength of the real exchange rate is broadly sustainable:

- entry into EMU at a level close to prevailing levels would appear to be comparatively costless relative to the baseline case where the UK stays out. Even if interest rates were cut to euro area levels immediately, and if the exchange rate were assumed to fall to its entry rate immediately, then the predicted effect on inflation and output would be rather moderate;
- if, instead, a low entry rate is mistakenly chosen, the transition path would be likely to imply higher inflation and greater output volatility. This is because this rate would be considerably below the equilibrium rate. This could be partly moderated by having either tighter monetary policy during the pre-entry period or a significant fiscal tightening over the transition. But for all such cases, the analysis points to outcomes that would be considerably worse than either the option of staying out or of joining EMU at prevailing rates.

...or that real exchange rate depreciates over transition **24** Under the alternative assumption that the real exchange rate is expected to depreciate outside EMU towards a medium-to-long term value of the equilibrium rate:

- under this set of assumptions, entry at an exchange rate close to prevailing rates would now imply deflationary pressure in the UK relative to the case outside EMU where the real exchange rate was expected to depreciate. With nominal exchange rate adjustment ruled out, the required depreciation of the real exchange rate would need to come about solely through lower inflation in the UK than in the euro area. And to achieve this, given that wages and prices are typically slow to adjust, this would require a period where UK output would need to operate below potential. This would need to be sustained for as long as would be necessary to bring down the UK price level to levels consistent with the lower required real exchange rate; but

- importantly, immediate entry at the long-run equilibrium rate would not necessarily be costless either. Provided the forces underpinning the prevailing exchange rate were set to persist beyond the near term, the immediate effect of a lower entry rate would be inflationary just as before. As before, fiscal or monetary policy can be used to dampen this effect. And because the real bilateral exchange rate is expected to depreciate anyway, the scale of this tightening does not need to be as large as in the earlier case;
- even so, when the real and nominal exchange rate is expected to depreciate to its medium term equilibrium value outside EMU, there may be a less costly transition strategy. This would be where entry to EMU is delayed until the required depreciation of the real exchange rate has taken place.

25 Although the model-based scenarios of this study have been carried out under particular assumptions about the assumed baseline path outside EMU, and under different transition strategies, the analysis of this paper is of more general use. It is intended to provide a toolkit for policymakers to allow them to apply the underlying economic principles to the transition problem, however the economy looks at that time and whenever it is carried out. The key insight is that entry conditions should be chosen to be as appropriate as possible to limit the transition costs. It has shown that consideration of monetary and fiscal policy strategies may facilitate adjustment but these will not eradicate costs arising from poor initial conditions. The trade-offs arising from these different options are for the assessment to consider.

26 This study informs the assessment of the convergence test, the first of the Government's five economic tests for EMU entry; the flexibility test, the second test; and the growth, stability and jobs test, the fifth test.

INTRODUCTION

The scope of the study

I.1 The analysis in this study is intended to inform discussion and evaluation of the possible transition costs in the event that the UK might enter EMU. These are defined as those macroeconomic costs that arise for the UK economy in the process of moving from the current monetary regime of inflation targeting to another where the UK is a member of EMU. For the purposes of this study, these do not include microeconomic costs that would be incurred in changing the currency from sterling to euro notes and coins. Nor does this study consider any change in macroeconomic costs caused by differences in the response of the UK economy to ongoing shocks inside EMU compared to outside. That issue is examined in the EMU study *Modelling shocks and adjustment mechanisms in EMU* by Dr Peter Westaway.

I.2 The overall aim of the study is to provide a conceptual framework to aid policymakers in their thinking about the transition issue. It also considers how they might ideally go about implementing this type of regime change so as to minimise the transition costs. A particular focus of the study is to examine how the euro-sterling conversion rate on entry might ideally be chosen. More generally it considers how macroeconomic policy might be set in any transition period up to and beyond entry itself. This set of policy choices is referred to as the 'transition strategy'.

I.3 It might be argued that questions relating to the implementation of UK entry should only arise once the Government's five economic tests are judged to have been met and the decision to join EMU has been taken. But transition costs form an important part of the overall cost-benefit calculus, and so should be taken into account in any decision about whether and when to join EMU. Moreover the timing of possible entry and the macroeconomic conditions surrounding any transition are likely to have a major bearing on the extent to which the UK economy is deemed to be converged. So in this sense, the study can also be seen as informing the analysis of the five tests themselves.

Elements of the transition strategy

I.4 Much of the popular discussion of how the UK might enter monetary union is dominated by consideration of one issue, the question of the appropriate euro-sterling conversion rate. Certainly, as the analysis that follows will demonstrate, the question of how the ideal entry rate should be chosen is indeed a crucial aspect. And economic history in the UK has tended to suggest that previous decisions to enter fixed exchange rate regimes were not based on an appropriately rigorous analysis of the terms of entry (see Balls, 2002, for a general discussion of this issue and Wren-Lewis *et al*, 1991, which specifically suggested that UK entry to the ERM in 1990 had taken place at an overvalued rate).

I.5 But there are other transitional considerations which policymakers would need to deliberate upon in weighing up the overall balance of costs and benefits, including:¹

- Should entry occur soon as is practically possible, or would there be value in delaying entry?
- Once the entry date had been decided, when should the final locking of exchange rates take place and how would it be achieved?

¹ And there are more, for example, would policymakers be likely to be constrained in their choice of entry rate by political considerations?

- How would monetary policy in the UK and in the euro area be conducted in the transitional period between announcement and entry?
- How can fiscal policy instruments be used to manage the transition process?

Using models to inform the analysis of transition

1.6 One way to inform these judgements is to compare predicted outcomes arising from different policy decisions as simulated by empirically estimated economic models. This approach is taken in a later section of this paper where NiGEM, the National Institute's Global Econometric Model, is employed to examine the possible implications of different transition scenarios for UK entry into EMU. The same approach is taken in the exercise described in Annex B, where a 'what if' or 'counterfactual' analysis of UK entry into EMU in 1999 is carried out. This illustrates what might have happened to the UK economy if the UK had joined EMU with the first wave of members in 1999.

1.7 Inevitably, however, any policy conclusions derived from the simulation results of a particular econometric model may not be robust across models. Furthermore, the necessary complexity which is associated with empirically based models can sometimes obscure the underlying principles behind the policy problem.

1.8 Accordingly, this study begins by examining the 'transition problem' in a simplified and stylised framework, but one that allows the different dimensions to the problem to be disentangled. This not only allows a clear partitioning of the separate strands of the argument, but also makes it easier to understand how the empirical evidence relates to these strands.

Transition costs in the overall cost-benefit analysis of EMU

1.9 Before beginning, it is worth pausing to consider further whether this 'transition issue' really matters, and the extent to which it influences any decision to enter EMU or not. Ultimately, the decision to enter a monetary union involves weighing up costs and benefits.² Since different transition strategies will imply different macroeconomic outcomes – both relative to each other and relative to a policy of staying outside the monetary union – then undoubtedly the cost-benefit analysis should take account of the transition strategy.

1.10 It is important to recognise, however, that the costs associated with the shock of transition itself are likely to be relatively short-lived. This is a crucial point that underpins much of the analysis in this study. Yet it is a point that is frequently misunderstood. Often, it is argued that UK membership of EMU would only be a success if the initial terms of entry were appropriate. The argument goes that if the entry rate were 'wrong', say because it were deemed to be uncompetitive, then the conditions of membership of EMU would be permanently adverse because that rate would be irrevocable.

1.11 But, while the entry rate would determine the nominal exchange rate, it is the real exchange rate that determines competitiveness, and this will ultimately be determined by real, or fundamental, factors. In the long run it is generally assumed that wages and prices are eventually able to adjust. The long-run level of competitiveness should therefore be independent of the policy regime, and certainly independent of the entry rate into the monetary union. So any misalignment of the real exchange rate would ultimately disappear.³

² This cost-benefit analysis may be implicit, or it may be explicit in the sense that an attempt is made to quantify it.

³ Of course, the process by which this occurs will differ inside and outside EMU. This issue is discussed in detail in the EMU study *Modelling shocks and adjustment mechanisms in EMU* by Dr Peter Westaway.

I.12 The one caveat to this long-run neutrality argument would be if the economy were subject to ‘hysteresis’ effects, that is where large movements away from equilibrium might affect the equilibrium of the economy itself.⁴ This type of effect should not be wholly discounted, and provides a strong motivation for ensuring that, in the event of joining EMU, the entry rate decision is based on rigorous economic analysis. But it remains the case that a careful analysis of the transition strategy is necessary even in the absence of hysteresis effects.

I.13 Of course, even if these costs were short-lived, this does not imply that they are any less important than ongoing costs in the cost-benefit calculations. In this sense, they are comparable in nature (though not necessarily in scale) to the changeover costs associated with changing notes and coins. In the overall cost-benefit analysis, the one-off costs need to be added to the other ongoing costs associated with the loss of an independent monetary policy adjustment mechanism and they need to be tallied against any permanent benefits of being in a monetary union.⁵

I.14 On most plausible calibrations, and given the margins of uncertainty surrounding any cost-benefit calculations, it seems likely that the one-off costs would be much smaller than either the permanent benefits or the on-going costs. Nevertheless, they could still be large enough, in some circumstances, to tip the balance of overall costs and benefits decisively.

I.15 But there is one important sense in which the one-off costs associated with transition are quite different to those associated with other one-off costs: transition costs are likely to be affected by policy choices. So even if the transition strategy were unlikely to swing the judgement on whether EMU was in the long-term interests of the UK economy, it may still have an important bearing on any decision about how, when and on what terms the UK should enter.

I.16 Therefore in assessing the option of joining EMU, elements of the transition strategy should be designed to minimise these transition costs. The rest of this study analyses this issue in depth. The plan of the study is as follows.

Contents of the study

I.17 Section 2 briefly outlines the important practical elements of the transition strategy that would need to be considered in the event of a decision to join EMU. Section 3 then considers these practical questions in a stylised framework, starting with the simplest example, then gradually complicating the problem, i.e. making it more realistic, on a step-by-step basis. A simple stylised calibrated macroeconomic model is introduced as a vehicle for illustrating the principles involved in each aspect of the EMU transition issue; Annex A provides details of this model.

I.18 Section 4 brings empirical evidence to bear on the policy framework described in Section 3. This is done by deriving predictions, ultimately still stylised, based on the results of an econometrically estimated model. These concern how and when the UK might join EMU. They illustrate the predicted macroeconomic consequences of different assumed transition strategies under different maintained assumptions about how the fundamentals of the economy might be expected to evolve. Annex B briefly describes a comparable ‘what if’ analysis of the possible outcome that the UK would have experienced if the UK had entered EMU along with the other founder countries in 1999.

⁴ For example, long spells of unemployment may cause human capital to be eroded. Or in this context, a prolonged disequilibrium may cause firms to relocate abroad.

⁵ These might be associated, for example, with the saving in transaction costs, or with possible increases in trade with EMU partners.

I.19 Section 5 attempts to draw out the policy implications, comparing the transition costs associated with the different stylised policy scenarios examined. The study concludes by emphasising that the most important role of the study is to provide an analytical toolkit to aid policymakers in their thinking about the transition. So continuing macroeconomic developments and, in particular, movements in the euro-sterling exchange rate, might imply that the stylised scenarios examined here might become less realistic. But the underlying economic principles involved should still remain valid whenever the analysis of the transition is carried out.

2

ENTERING A MONETARY UNION: KEY CONSIDERATIONS

The transition costs upon entry to monetary union will be affected by three sets of considerations.

The macroeconomic conditions facing the UK economy at the point when the intention to enter EMU is announced will determine the scale of the transition. In particular, the transition costs will be larger if the equilibrium of the UK economy inside EMU is different to that outside, say because interest rates are expected to differ. And if the UK is in the process of responding to a shock, the subsequent adjustment costs inside EMU may be more costly than those arising outside because of the loss of an independent monetary policy.

Transition costs will be affected by the ease with which firms and households respond to the shock of transition. These will be smaller the more flexible are prices.

The policy choices of policymakers, i.e. the transition strategy, will have an important bearing on the extent of transition costs. These involve decisions on the entry date, the nominal entry rate, and on monetary and fiscal policy settings over the transition phase.

2.1 This section sets out in broad terms the relevant considerations to be faced by policymakers in designing a transition strategy in the event of the UK taking a decision to join EMU.

Key determinants of transition costs

2.2 The ensuing macroeconomic consequences would be determined by three main sets of factors:

1. the macroeconomic conditions prevailing in the UK at the time that EMU entry is decided;
2. the assumed response of firms and households in the UK, and by policymakers outside the UK, in particular at the ECB; and
3. the policy choices made by UK policymakers, i.e. the transition strategy itself.

2.3 While it is only the policy choices comprising the transition strategy itself that can be chosen directly by UK policymakers, it is necessary in designing that strategy to understand the nature of the economic environment faced when the transition to EMU is implemented.

What causes transition costs?

2.4 The macroeconomic conditions prevailing in the UK economy at the time that EMU entry is announced are important because they determine the scale of the transition. They can affect the costs in two ways:

- first, even if the UK economy were in a position of equilibrium just before entry, EMU membership might imply a different medium-term equilibrium and it may be costly for the UK economy to adjust to that; or
- second, outside EMU, the UK economy may be away from its long run equilibrium because it is in the process of responding to a shock. In that case, it may become more costly to adjust to this shock inside EMU because of the loss of a UK-specific interest rate response and the loss of the shock-absorbing role of the euro-sterling nominal exchange rate.

The response of the economy to transition 2.5 The responses of different economic agents also have an important bearing on the macroeconomic consequences of different transition scenarios. Key considerations will include:

- the speed with which wages and prices adjust to shocks;
- the extent to which financial asset prices, in particular the exchange rate, move in anticipation of expected changes in the policy regime; and
- the manner in which the ECB responds to prospective UK entry into EMU. This could take a number of forms. Most simply, ECB interest rates would continue to respond to euro area aggregates until the UK entered EMU, at which point the ECB would begin to respond to aggregates defined for the new euro area including the UK. Alternatively, the ECB could anticipate the UK's entry by immediately beginning to respond to the wider version of the euro area.

The transition strategy 2.6 Given the economic environment that the UK economy faces, it would be for UK policymakers to decide the various elements of the transition strategy.¹ For analytical simplicity, the Maastricht exchange rate criteria are not considered here.

2.7 From the UK perspective, joining EMU would entail policymakers deciding upon a number of policy parameters. These are as follows:

- **the entry date** at which the sterling-euro rate would be irrevocably fixed and when UK nominal interest rates would coincide with those set by the ECB. An important consideration here is whether, even if EMU entry were deemed to be in the long-term interest of the UK economy, it might be possible to lessen overall transition costs by entering at a later date. There may also be an 'option value' to delaying entry if further information about what entry conditions might be appropriate were expected to become available in the future.² This consideration forms an important element of the 'transition strategy' as defined here;³
- **the nominal entry rate** at which sterling would be converted to euro on the entry date. Again, the analysis abstracts from any constraint arising from the need to agree on an entry rate with EMU partners;

¹ The term 'UK policymaker' is deliberately ambiguous. For most, if not all, aspects of the strategy, the responsibility would rest with the Treasury and the Government. The question of who would be responsible for setting monetary policy once a decision to enter EMU had been taken is not discussed here, either in terms of its objectives or in terms of its implementation.

² See Dixit and Pindyck (1994) for the original exposition of the option value of waiting in the context of investment behaviour.

³ In practice, there are other dimensions relating to the entry date, for example relating to when euro notes and coins would first be used and when sterling notes and coin would cease to be legal tender. But the analysis here abstracts from such issues.

- if the entry date were not immediate, **the monetary policy strategy in the transition phase** (i.e. between the announcement and the entry date) would need to be defined.⁴ If it is assumed that the announced entry rate would be completely believed by foreign exchange market operators and further, if it is assumed that the exchange rate would move over the transition so as to eliminate any opportunity for arbitrage profits, then policymakers would face a choice. They could either:
 - a. choose the interest rate path, effectively leaving the exchange rate transition path to be determined by the markets; or
 - b. choose the desired exchange rate path, effectively leaving the interest rate path to be determined by the markets.⁵
- apart from monetary policy, policymakers may also wish to consider fiscal policy options and announce a **fiscal policy strategy** designed to ameliorate the transition costs of EMU entry.

**Organising
framework for
rest of the study**

2.8 The three sets of considerations defined in this Section provide a practical checklist for policymakers in designing a transition strategy for EMU entry. They also provide the organising principle for the rest of this study where different assumptions about the economic environment, the way that the economy responds, and the way that policy settings are chosen, are explored in the context of a modelling framework. This approach is intended to provide a toolkit for policymakers to inform the design of any transition strategy that might need to be taken in practice. The rest of this study develops such a toolkit and illustrates how it might be used to examine the question at issue relating to UK entry into EMU.

⁴In principle, a well-defined transitional monetary policy could itself be used to define the expected future entry rate at the pre-announced entry date. But the implied future entry rate would continually change in the face of shocks to the economy. So in practice, it is more realistic to assume that a pre-announced entry rate would need to be chosen.

⁵Note that, under these assumptions, there is no necessary reason why the exchange rate should jump to the announced entry rate immediately. In fact, under the maintained assumption of uncovered interest parity condition (UIP), the only circumstance where this would happen would be if it were decided to bring UK interest rates immediately into line with ECB interest rates.

In considering entry into a monetary union, understanding of the relevant policy considerations can be facilitated by use of a macroeconomic model. This allows the transition costs to be predicted under different assumptions about the elements of the transition strategy. And the sensitivity of these predicted outcomes can be examined with respect to different assumptions about the way the economy works and about the economic conditions faced when EMU entry takes place.

A stylised model of the UK economy and its interaction with the euro area is used to explain the analytics of the transition issue.

It suggests that if the UK economy were assumed to be in equilibrium at the point immediately before EMU entry and if UK interest rates were not expected to be changed by EMU entry, there would be no transition costs.

If the UK inflation target outside EMU were higher than that implied by EMU membership, there would be transition costs except in the unrealistic case where prices were able to adjust immediately. Transition costs could be modified by appropriate choice of the entry rate or by the use of fiscal policy as a stabilising mechanism during transition. Or the costs could be lessened by implementing the move to a lower inflation target before EMU entry occurred.

The final case examined is where the economy is away from its long run equilibrium path immediately before EMU entry. The entry rate could be chosen to return the real exchange rate to its long run equilibrium. In circumstances where it has been driven away from equilibrium by a 'financial market' shock, this may be appropriate. But if the level of the exchange rate were warranted by a real shock to fundamentals, then a different entry rate may be appropriate, and fiscal policy may again be required to ease the transition.

3.1 The main purpose of this study is to examine how different assumptions regarding the considerations described in Section 2 might affect the expected transition costs if the UK were to enter EMU. To do this, it is necessary to predict how the UK economy might evolve under different assumptions about the economic environment immediately preceding entry and under different assumptions about how the transition strategy might be implemented by policymakers. This requires the use of a macroeconomic model that attempts to articulate how the economy might respond.

3.2 To illustrate the relevant issues, this section adopts a simple stylised macroeconomic model. This focus on a small tractable model is helpful because it facilitates greater insight into the important analytical aspects of the transition problem. Then, having started with as simple a version of the problem as possible, the problem can gradually be made more realistic by building through successive steps, focusing at each step on the additional considerations introduced by each layer of complexity.

3.3 The focus of the analysis will be on the effects of moving from one policy regime to another, i.e. between the UK outside EMU and the UK in EMU. This exercise is not concerned with how the UK economy would respond to ongoing shocks inside EMU compared to outside. This is the focus of another EMU Study on *Modelling shocks and adjustment mechanisms in EMU* by Dr Peter Westaway. But importantly, as already noted in Section 2, if the UK economy is in the process of responding to a pre-existing shock at the time when EMU entry is announced, this will be relevant to the choices made in the transition strategy.

3.4 In order to illustrate the issues, a simple stylised three ‘country’ model (termed the ‘Three Bears’ model) is adopted. It is based on a conventional simplification of the monetary transmission mechanism as commonly used for the purposes of macroeconomic policy analysis. But the model here has been specifically developed to analyse the output-inflation process of the UK economy inside and outside EMU. A model listing is given in Annex A. Box 3.1 gives more details.

3.5 For simplicity, the analysis of EMU entry in the stylised analysis of this section will assume that the announcement of any decision to join EMU coincides with EMU entry itself (except in those cases where an explicit delay is examined). To anticipate, the later less stylised empirical analysis of Section 4 will build in a more realistic assumption that EMU entry would take place some eighteen months after announcement of the intention to join.

3.6 The stylised model will be used to examine the macroeconomic implications of EMU entry for the UK under a range of assumptions about the economic environment at the point immediately preceding the announcement of EMU entry. The cases to be examined are as follows:

- (i) Assuming that economies are initially in equilibrium and that the UK and euro area inflation targets are equal:
 - under conditions of sticky or flexible prices (see Charts 3.1(a)-(f));
 - assuming a delay between announcement and EMU entry (see also Charts 3.1(a)-(f));
- (ii) Assuming that economies are initially in equilibrium and that the UK inflation target exceeds that of the euro area:
 - under conditions of flexible prices (see Charts 3.2(a)-(f));
 - under conditions of sticky prices (see Charts 3.3(a)-(f));
 - under different assumptions on how policy might be used to modify the transition to a lower inflation rate using:
 - o a choice of entry rate (see Charts 3.4(a)-(f)),
 - o active fiscal policy (see Charts 3.5(a)-(f)), or
 - o a choice of entry date (see Charts 3.6(a)-(f)).

Box 3.1: The ‘Three Bears’ model

A simple stylised three ‘country’ model has been specifically developed to analyse the output-inflation process of the UK economy inside and outside EMU; because this is specified in terms of a large, medium-sized and small country, it is termed the ‘Three Bears’ model. It is based on a conventional simplification of the monetary transmission mechanism as commonly used for the purposes of macroeconomic policy analysis, both in policymaking institutions (see for example Bank of England, 1999, Britton and Whitley, 1997) and by academic commentators (see Rudebusch and Svensson, 1999, Clarida *et al.*, 2000). The key features of this model are as follows:

- in the long run output is determined by the supply-side, and as such is invariant to the monetary policy regime;^a
- output is determined by demand conditions in the short run, governed by a IS-curve relationship. This is affected negatively by real interest rates and negatively by the real exchange rate (*vis à vis* both the euro area and the rest of the world). Demand conditions in the euro area and the rest of the world are assumed to affect demand in the UK;
- inflation is determined by a simple Phillips curve relationship. This is of the accelerationist form (though it embodies backward and forward-looking inflation expectations), which implies that inflation will tend to rise when output is above potential and fall when it is below. Since inflation is defined in terms of consumer prices, the real exchange rate will impinge additionally on inflation;
- exchange rates are assumed to be determined by the UIP condition, so bilateral nominal rates move in line with nominal interest rate differentials between countries, but adjusted for any risk premium effects. Despite being a rather poor representation of exchange rate behaviour, UIP is a reasonably neutral assumption which is not obviously dominated by any other theoretical construct;
- interest rates are used as the instrument of monetary policy; and
- fiscal policy is assumed to impinge on domestic demand; first via the operation of the automatic stabilisers, helping to dampen the response of the economy in the face of most shocks; and second, via an additional discretionary element which may be activated upon joining EMU to modify transition costs.

The benchmark version of the model is calibrated rather than strictly estimated. The parameter values are chosen to be empirically plausible in the light of responses estimated from more complex empirical models. In this study, the approach taken is to start with a simple version of this model, then gradually to make the model more realistic and policy relevant.

A listing of the model is contained in Annex A. A more complete description and theoretical justification of the model is contained in the EMU Study *Modelling shocks and adjustment mechanisms in EMU*.

^a This is a conventional assumption that is not intended to prejudge the possibility of permanent benefits in terms of higher output or employment on joining EMU.

- (iii) Assuming that economies are initially in disequilibrium and that the UK and euro area inflation targets are equal:
- where the disequilibrium is caused by a real shock to fundamentals;
 - o comparing the flexible and sticky price case (Charts 3.7(a)-(f)),
 - o comparing the flexible price outcomes inside and outside EMU ((Charts 3.8(a)-(f)),
 - o comparing alternative entry rate scenarios (Charts 3.9(a)-(f)), and when using active fiscal policy to manage transition (Charts 3.10(a)-(f)),
 - where the disequilibrium is caused by a financial shock (Charts 3.11(a)-(f)).

3.7 In all cases, the term *ex-ante* path or baseline will be used to refer to the path of the economy that would have occurred in the absence of a decision to join EMU.

3.8 The results from the stylised model will be presented in the form of charts showing six macroeconomic variables for each policy scenario; (a) the nominal bilateral €-£ exchange rate,¹ (b) the real bilateral €-£ exchange rate, (c) UK inflation, (d) the UK output gap, (e) UK nominal interest rates and (f) UK real interest rates. The frequency of the model calibration and hence of the charts is quarterly.

Economies in equilibrium; UK inflation target equals the euro area inflation ‘target’

3.9 In this case, the following assumptions are made:

- the UK inflation target outside monetary union is equal to that of the euro area,² say at 2 per cent, and that ‘equilibrium’ real interest rates are equal in the UK and the euro area (say at 3 per cent). These assumptions imply that *ex-ante* nominal interest rates are equal in equilibrium; and
- both economies are initially in equilibrium, so *ex-ante* UK inflation is at its target level and output is growing at potential. And similarly for the euro area.³

Immediate entry 3.10 Charts 3.1(a) to (f) illustrate the macroeconomic and financial market effects of an announcement of immediate entry of the UK into monetary union. These would generally be determined by how the expected path of the sterling exchange rate and UK interest rates would alter. But in this simple case, the outcome is straightforward and depicted in a rather uninteresting set of charts each characterised by a horizontal line. Expected nominal interest rates would be just as before. And the expected path of the newly locked sterling-euro exchange rate would be exactly as it would have been if the UK had stayed outside EMU. So the exchange rate would not need to respond. Inflation would accordingly remain on its previously expected target path and similarly output would be expected to remain at potential.

¹ The €-£ exchange rate is defined here, and elsewhere in the study, as the number of euros per pound.

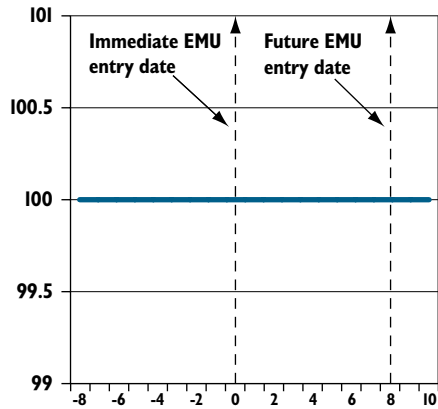
² The fact that the ECB does not have an explicit inflation target will be ignored.

³ This assumption has no implications for any possible structural differences between the economies relating, for example, to the structural unemployment rate or the level of GDP per head.

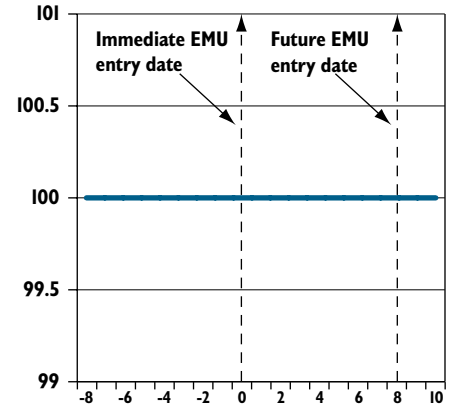
Chart 3.1: Stylised transition to EMU

- Economies initially in equilibrium
- *Ex-ante* inflation target equals euro area target

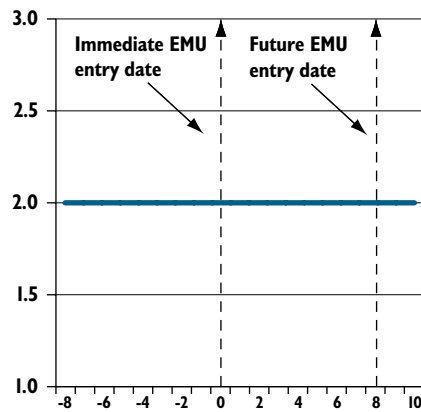
(a) Nominal €-£ exchange rate



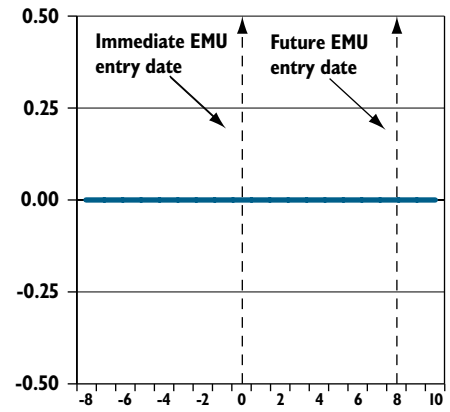
(b) Real €-£ exchange rate



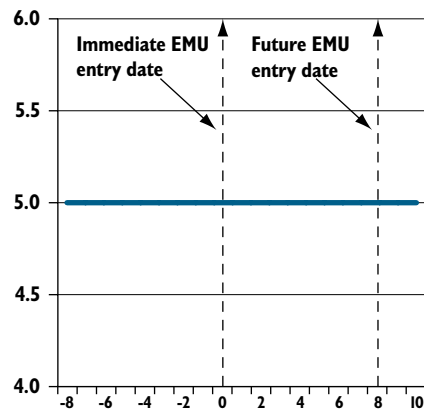
(c) Inflation



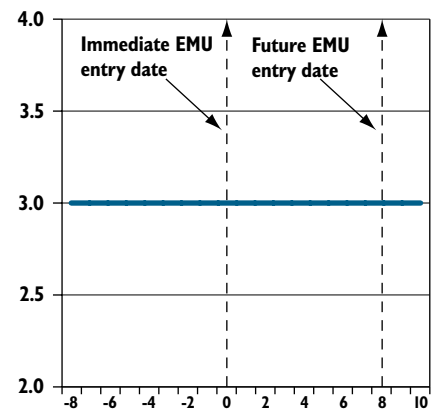
(d) Output gap



(e) Nominal interest rate



(f) Real interest rate



Entry with delay 3.11 A slightly more complicated situation arises in the case where it is assumed that EMU entry is announced to take place at some future date, here assumed to be after two years. In fact, the expected outcome is exactly the same as when EMU entry was assumed to be immediate. Expected inflation and hence expected future interest rates would be unaffected by the future regime change, so the current level of interest rates and the exchange rate would be unchanged by the announcement.

Price flexibility 3.12 In both of the foregoing cases, the degree of price flexibility would not make any difference since, by assumption, the economy is assumed to stay in equilibrium. Price flexibility only matters because it affects the economy's ability to adjust to shocks i.e. when the economy is away from equilibrium.⁴ But in the simple cases just considered, UK output would remain at potential and neither output nor inflation would be affected by transition. In other words, the economy would stay in equilibrium and transition costs would be zero.

Economies in equilibrium; UK inflation target exceeds the euro area inflation 'target'

3.13 In this second slightly more complicated case, the inflation target of the euro area is assumed to be lower than the UK's *ex-ante* inflation target (say it is 1 per cent for the euro area compared to 2 per cent for the UK outside of EMU). Later, the empirical analysis will adopt a specific assumption as to whether the long-run UK inflation rate would change on moving from an inflation-targeting regime to EMU. Here, it is simply the analytics of the problem that are examined.

Immediate entry 3.14 Again, first consider the effects of an announcement of immediate entry of the UK into EMU. If there were no price stickiness in the economy, in particular so that inflation expectations adjusted instantly to the new inflation rate, then the transition would be just as painless as before. Expected inflation would fall immediately to the euro area level and prices would begin to rise at the new lower rate.⁵ The nominal exchange rate, now locked under EMU, would appreciate relative to its *ex-ante* path which had been depreciating because of the higher inflation rate in the UK (see the dotted line on chart 3.2(a)). The real exchange rate would be unaffected, with the effect of the higher nominal exchange rate exactly offset by the lower inflation rate. And output would be unaffected too, again continuing to grow in line with potential. Charts 3.2(a) to (f) illustrate.

Entry with delay 3.15 As with the first simple example, if a future entry date were announced in advance, there would be no reason why the required fall in inflation upon entry to EMU should not take place costlessly. The paler lines in Charts 3.2(a) to (f) illustrate this case.

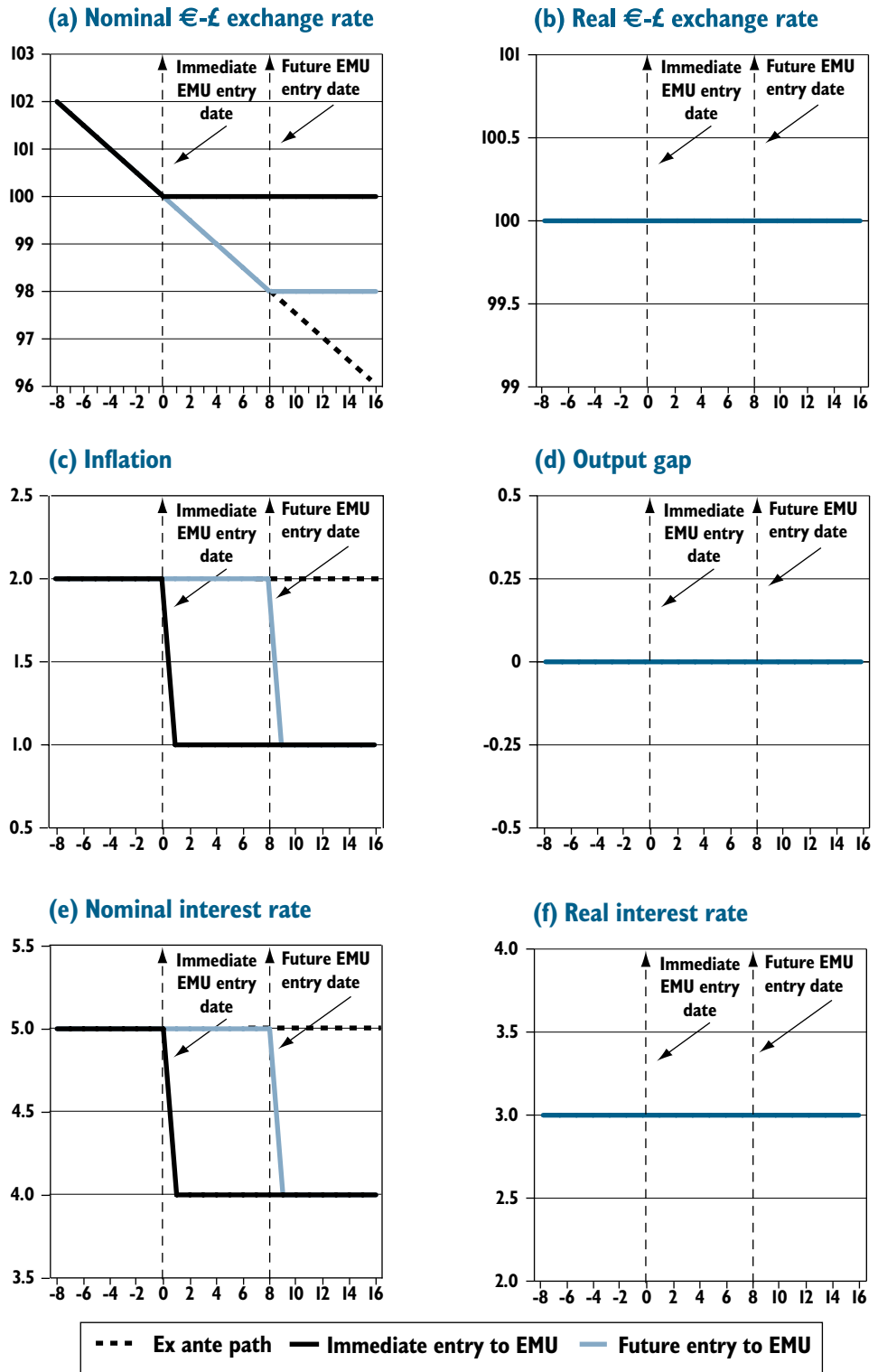
Implications of price stickiness 3.16 But of course, it is rather unrealistic to assume that prices adjust so quickly. Once the more realistic assumption of sticky prices is introduced, the circumstances where the transition to EMU is costless no longer apply. Box 3.2 explains how different degrees of price flexibility are modelled in the 'Three Bears' model.

⁴ The adjustment mechanism of the economy inside and outside EMU under different assumed degrees of price flexibility is examined in the EMU study *Modelling shocks and adjustment mechanisms in EMU*.

⁵ Even with flexible prices, a conventional backward-looking measure of annual inflation would take four quarters before the transition to the new inflation rate was complete. For presentational simplicity, the forward-looking inflation measure which adjusts immediately is presented in Chart 3.2(c).

Chart 3.2: Stylised transition to EMU

- Economies initially in equilibrium
- Perfect price flexibility
- Inflation target in UK exceeds the euro area



Box 3.2: Modelling price stickiness

Price stickiness is introduced into the stylised model via the assumption that inflation dynamics are governed by an expectations-augmented Phillips curve. Private sector expectations are assumed to be partly based on recent experience of inflation, and partly on the basis of forward-looking expectations. In its simplest form, this can be written as:^a

$$\pi_t = \alpha.\pi_{t-1} + (1 - \alpha).\pi_{t+1}^e + \theta.ygap_t \quad (1)$$

where:

π denotes the inflation rate, superscript 'e' denotes expectation, $ygap$ denotes the output gap, α denotes the degree of backward-lookingness in inflation expectations and θ is the responsiveness of inflation to the output gap.

The more quickly that wage and price setters come to believe that monetary policymakers are serious about bringing down inflation, the less costly the fall in inflation would tend to be.^b When the credibility of the disinflation is complete (i.e. when $\alpha=0$), private sector expectations would adjust immediately to the new inflation target and the deflation would be costless.^c In this case, starting from a zero output gap, current inflation would fall immediately to equal the new target: i.e. the Phillips curve could be written as;

$$\begin{aligned} \pi_t &= \pi_{t+1}^e + \theta.ygap_t \quad (2) \\ &= \pi_{t+1} + \theta.ygap_t \end{aligned}$$

If, at the other extreme, wage and price setters are assumed to be completely backward-looking (i.e. if $\alpha=1$), then a simple 'accelerationist' Phillips curve is implied. Under this assumption, inflation only falls when output is below potential, according to:

$$\pi_t = \pi_{t-1} + \theta.ygap_t \quad (3)$$

In such a model, the policy problem is straightforward. Policy must be tightened so as to drive output below potential for as long as is necessary for the inflation rate to fall to the new lower level. The scale of the required tightening (sometimes known as the sacrifice ratio) is determined by the parameter θ . In this case, disinflation is inevitably associated with output costs.

^a In fact, in the 'Three Bears' model used here, as described in Annex A, the assumed inflation dynamics are slightly more complicated and include additional effects from the real exchange rate. But the intuition on the role of the output gap is unaffected.

^b See Blake and Westaway (1996) for an illustration of this credibility effect in a similar model to the one used in this study.

^c In fact, Ball (1994) shows that in a model of pure price stickiness, it is possible for a policy of disinflation to cause an increase in output if the policy is credibly announced in advance.

3.17 In many respects, this transition problem of entering a monetary union which has a lower inflation rate is similar to the standard disinflation problem faced by an independent monetary policymaker attempting to cut the target inflation rate. This issue has been widely studied in the academic literature, first in the context of the attempts of developed economies to bring down their inflation rates during the 1980s (see for example Buiters and Miller, 1985) and later when developing economies were attempting to curb high rates of inflation. Here the problem is closely related. But now, inflation reduction is brought about by joining a monetary union where the inflation target is lower. In the stylised example, the required disinflation is 1 percentage point.

3.18 Charts 3.3(a)-(f) illustrate the effects of the UK entering EMU under the assumption that prices are sticky. Here, an intermediate case is assumed, implying a plausible degree of inflation inertia (setting $\alpha=0.75$)⁶ implying that agents are more backward-looking than forward-looking. As in Charts 3.2(a)-(f), entering EMU would imply a fall in the UK's inflation rate from 2 per cent to 1 per cent, but now it would take time:

- relative to the flexible price outcome shown in Chart 3.2, inflation now takes around a year to adjust to the new lower level of the inflation target inside EMU while output falls by almost 0.4 per cent over the first year;
- the main channel through which this occurs is the nominal bilateral sterling-euro exchange rate which, though fixed on entry, has appreciated relative to the *ex ante* case. Correspondingly, the real exchange rate appreciates by almost 1 per cent in the first year; and
- interest rates fall to euro area levels immediately (they do not fall by 1 percentage point because euro area inflation rises in response to the depreciation in the effective exchange rate of the euro area). Despite the immediate fall in nominal interest rates, the relatively prompt response of inflation implies that the forward-looking measure of real interest rates, displayed in Chart 3.3(f), hardly falls on impact. To the extent that it does, this tends to boost demand and slows down the required fall in inflation towards its lower target. But within the first year, real interest rates actually rise in response to the increase in euro area inflation (now including the UK) above target.

3.19 In fact, the responses shown in Chart 3.3 may have exaggerated the costs of using entry into EMU as a device for lowering the long-run inflation rate. Policymakers would have some choices to make.

Using the entry date to modify transition

3.20 There would be a choice over the **nominal entry rate**. This will be discussed further later when the problem of entering EMU from a possible position of disequilibrium will be considered. For the time being, Charts 3.4(a) to (f) illustrate, indicating what would be expected to happen if the UK were assumed to have entered EMU, first as in the previous chart, then also at a lower and higher nominal exchange rate (see the dark dashed and light lines, respectively).

3.21 The lower entry rate would have the effect of mitigating the initial loss in competitiveness and hence would lessen the fall in output. But in fact the benefit of this approach would be modest, since the output costs would tend to be delayed rather than eliminated. Alternatively, too, the reduction in inflation could be made quicker still by choosing an entry rate higher than the prevailing rate, giving rise to a sharper fall in output. Charts 3.4(a)-(f) again illustrate.

Using fiscal policy to modify transition

3.22 It would also be possible to modify the transition costs of entry to EMU by the **active use of fiscal policy**. Charts 3.5(a) to (d)⁷ illustrate how the use of discretionary fiscal policy can modify the transition to the lower inflation rate inside EMU. In this case, fiscal policy is tightened so that the fall in the inflation rate is hastened, necessarily at the expense of a larger fall in output.

⁶ See Fuhrer and Moore, 1995, for the original derivation of the Phillips curve with $\alpha=0.5$ and Blake and Westaway, 1996, for the use of the same intermediate value, $\alpha=0.75$, as here.

⁷ For Chart 3.5, fiscal policy is shown in panel (a) and no charts are shown for real or nominal interest rates, or for the nominal exchange rate.

Chart 3.3: Stylised transition to EMU

- Economies initially in equilibrium
- Inflation inertia present
- Inflation target in UK exceeds the euro area

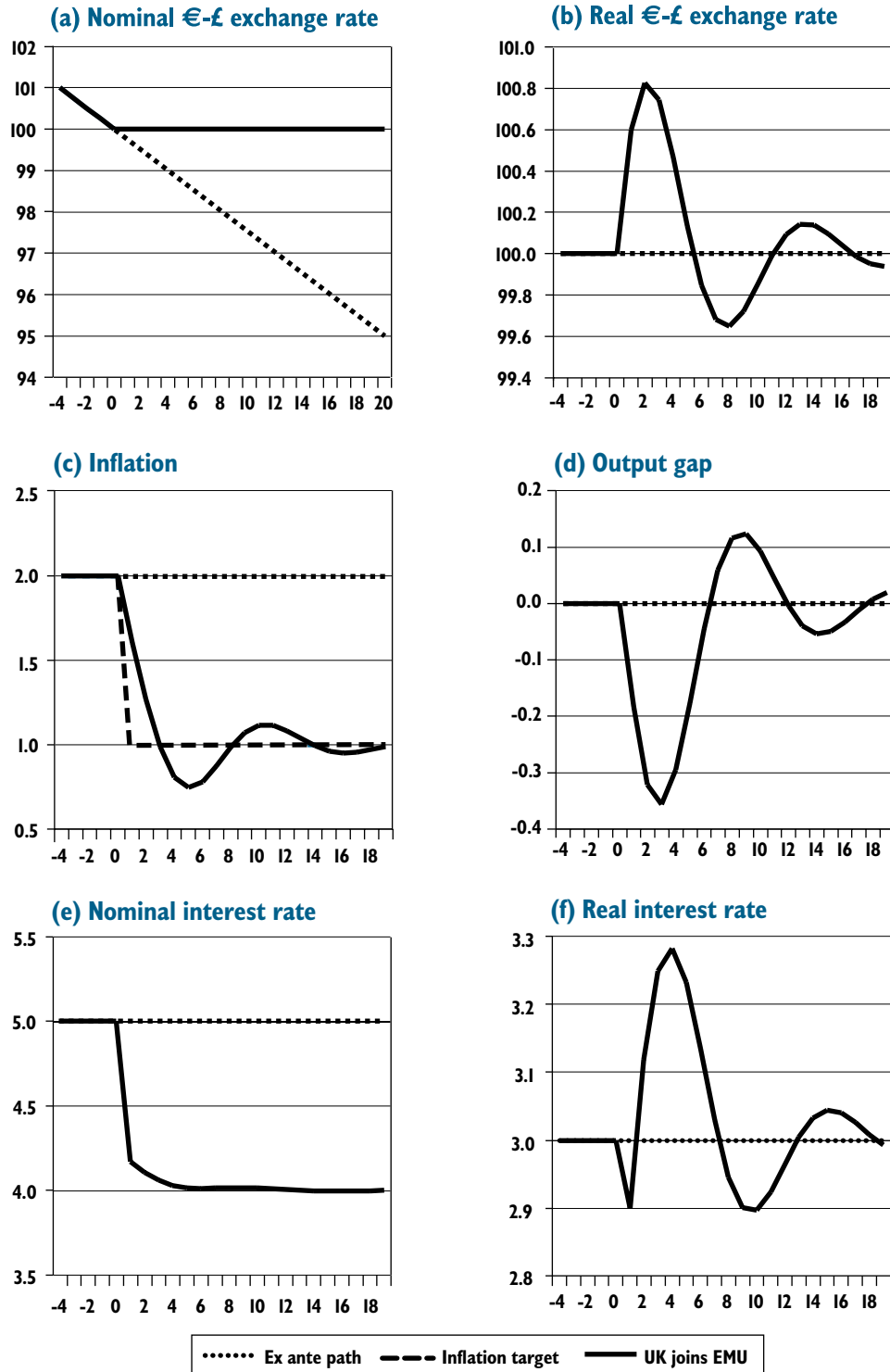


Chart 3.4: Fall in inflation target from 2 per cent to 1 per cent via entry to EMU: Entry at equilibrium exchange rate, 1 per cent above or 1 per cent below

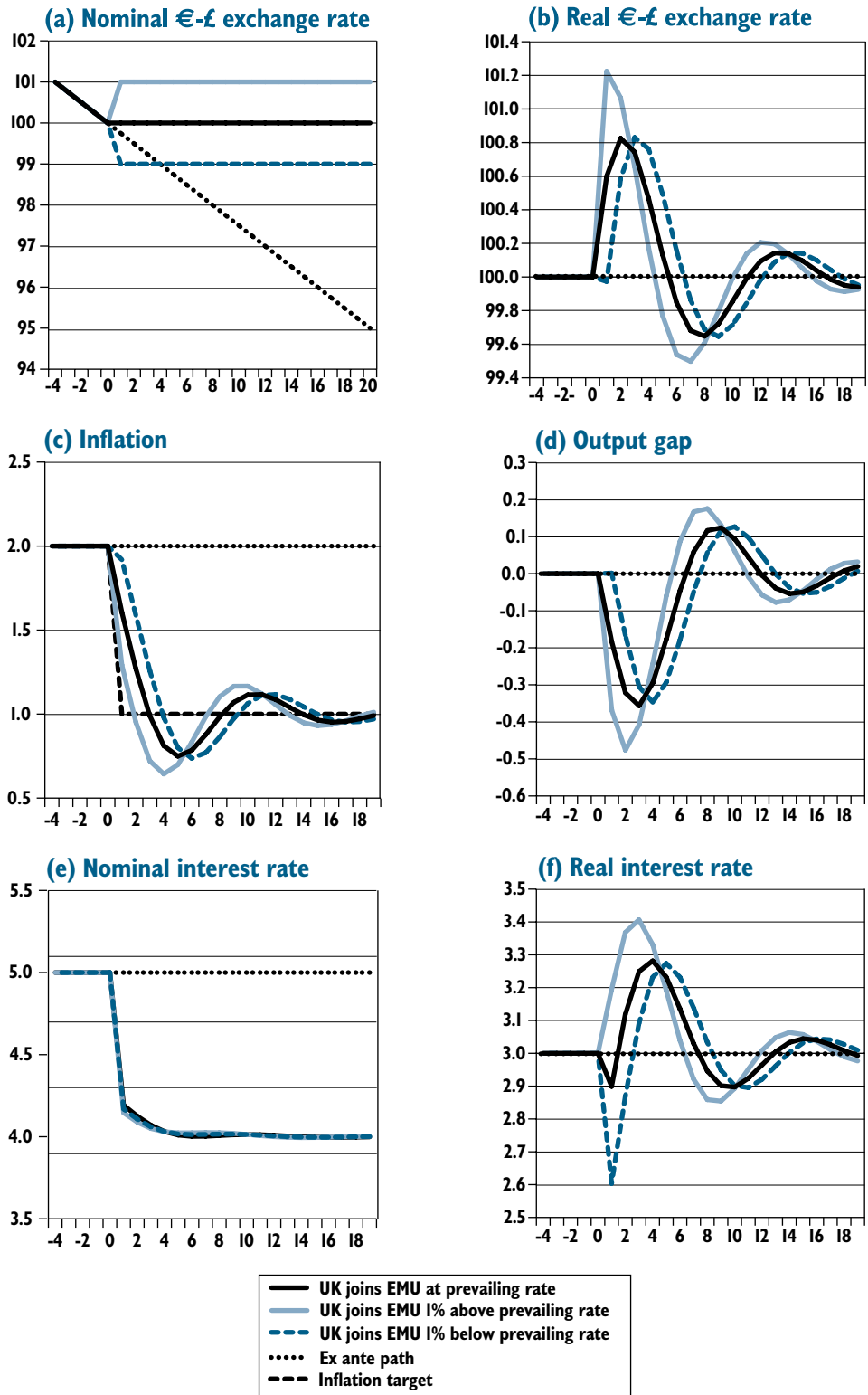
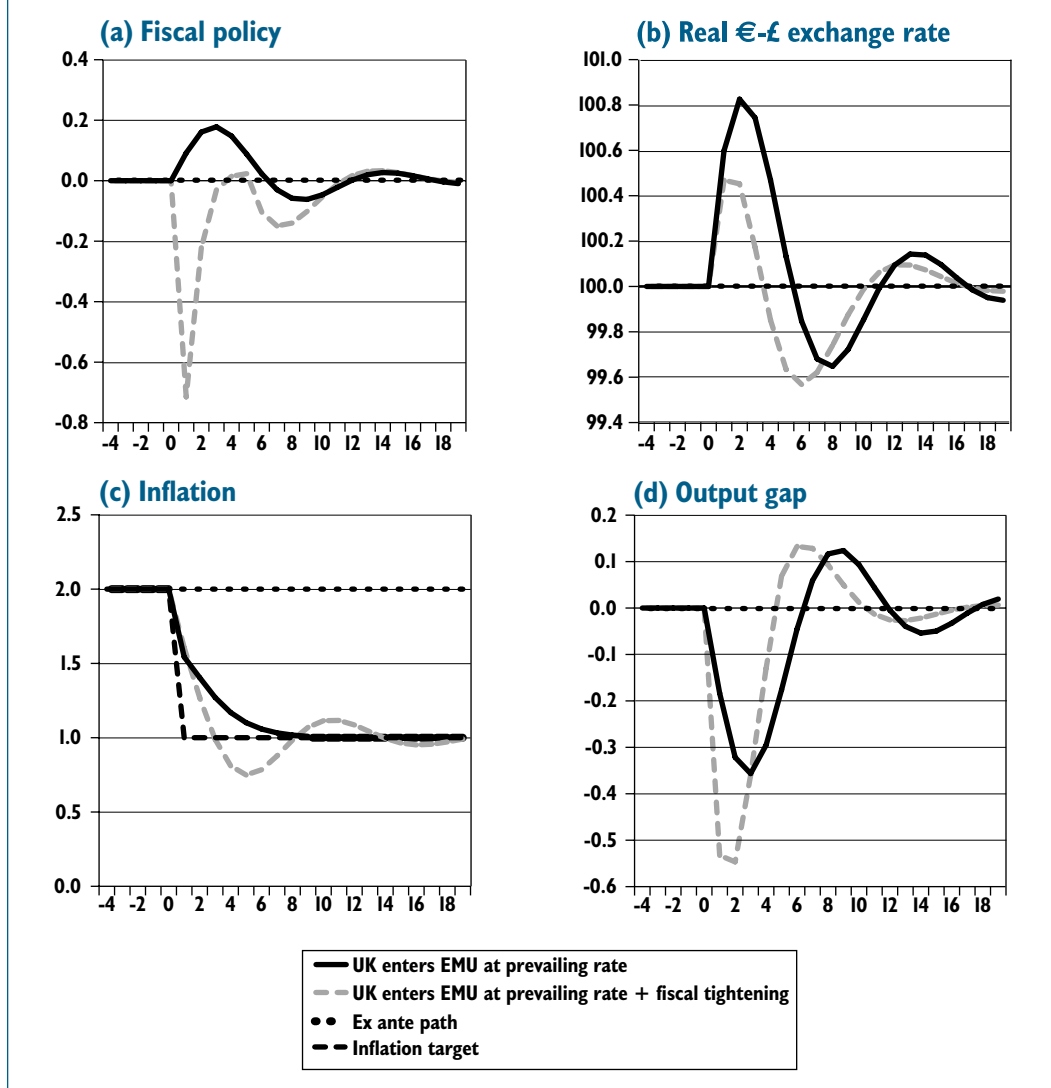


Chart 3.5: 1 per cent fall in inflation target via entry in EMU: Entry at equilibrium exchange rate, with and without active fiscal policy adjustment



Inflation reduction prior to EMU entry

3.23 Finally, it might be possible to mitigate the costs of reducing inflation within EMU by ensuring that the appropriate adjustment of inflation expectations **took place before** exchange rates were finally locked together. Indeed, this was the approach taken by the first wave of countries that aligned their inflation rates with other EMU members in advance of EMU itself through commitment to the Maastricht convergence criteria.

3.24 This can be illustrated by comparing the output and inflation responses previously shown in Chart 3.3 with alternative outcomes where inflation reduction takes place within the UK's inflation targeting regime. Charts 3.6(a)-(f) illustrate.

Disinflation via inflation targeting **3.25** If the inflation target were to be reduced under a regime of inflation targeting, real interest rates would be increased to restrict demand, bringing about a 0.25 per cent fall in output relative to potential.⁸ This would occur through two channels: first through the effect on domestic demand; and second, via the effect of the real interest rate differentials in raising the real exchange rate. Together these effects on output would bring inflation down via the Phillips curve. Importantly, though the lower inflation target would be achieved after three to four years, the price level would be higher than it would have been in the case where the target is achieved immediately. Initially, this causes the real exchange rate to appreciate. But since the real exchange rate must return to the same level in the long run, the price-level slippage is offset by a corresponding depreciation of the nominal exchange rates, Chart 3.6(a) illustrates.

Disinflation via price-level targeting **3.26** The significance of this long run depreciation of the nominal exchange rate is demonstrated by simulating the effects of the same fall in the inflation rate, but now under the alternative assumption that there is a price level target that is required to grow by 1 per cent less per annum. Here, inflation is required to fall as in the earlier case, but now it must occur without the price level slippage. So in this case, the nominal exchange rate does not depreciate in the long run. Charts 3.6(a) to (f) again illustrate. Now the output costs would be around a third larger, with output falling by 0.4 per cent below potential after one year. This is because with a price level target, not only would inflation have to be lower, but it would also temporarily have to undershoot its eventual equilibrium in order to claw back the price level slippage (see Chart 3.6(a) and (c)).

3.27 This focus on the costs of inflation reduction via a price-level targeting regime is relevant because there are strong similarities with the situation that would be faced if inflation needed to be reduced upon joining a monetary union. In that case the role of the price level ‘target’ would be played by the price level in the euro area. This is because, in the absence of a euro-sterling nominal exchange rate, the UK price level must on average move in line with the euro area price level.⁹ So as with explicit price level targeting, if entering EMU were to imply a fall in the inflation target, then starting from inflation at (or above) target it would go through an initial phase of being above the new target, and so would need subsequently to fall below target in order to claw back the price-level slippage. But unlike an explicit price-level targeting regime, domestic interest rates would no longer be available to manage the fall in the price level. Indeed, because nominal interest rates fall more sharply than inflation itself, the real interest rate would initially fall, providing an unhelpful upward impetus to UK prices.¹⁰ Instead, the real exchange rate would be the primary channel through which output would fall.

3.28 Overall, this analysis suggests that it would be less costly for the UK to bring about any required change in its target inflation rate within the current inflation-targeting regime rather than an alternative regime (though of course, a degree of price level slippage could also be allowed for in other regimes).¹¹

⁸ Although real interest rates increase as required, nominal interest rates actually begin to fall immediately. This is because private sector expectations of inflation adjust quickly to the new lower long run level. An arguably more plausible initial increase in nominal interest rates would occur if the private sector’s perception of the lower inflation target were assumed to be more gradual.

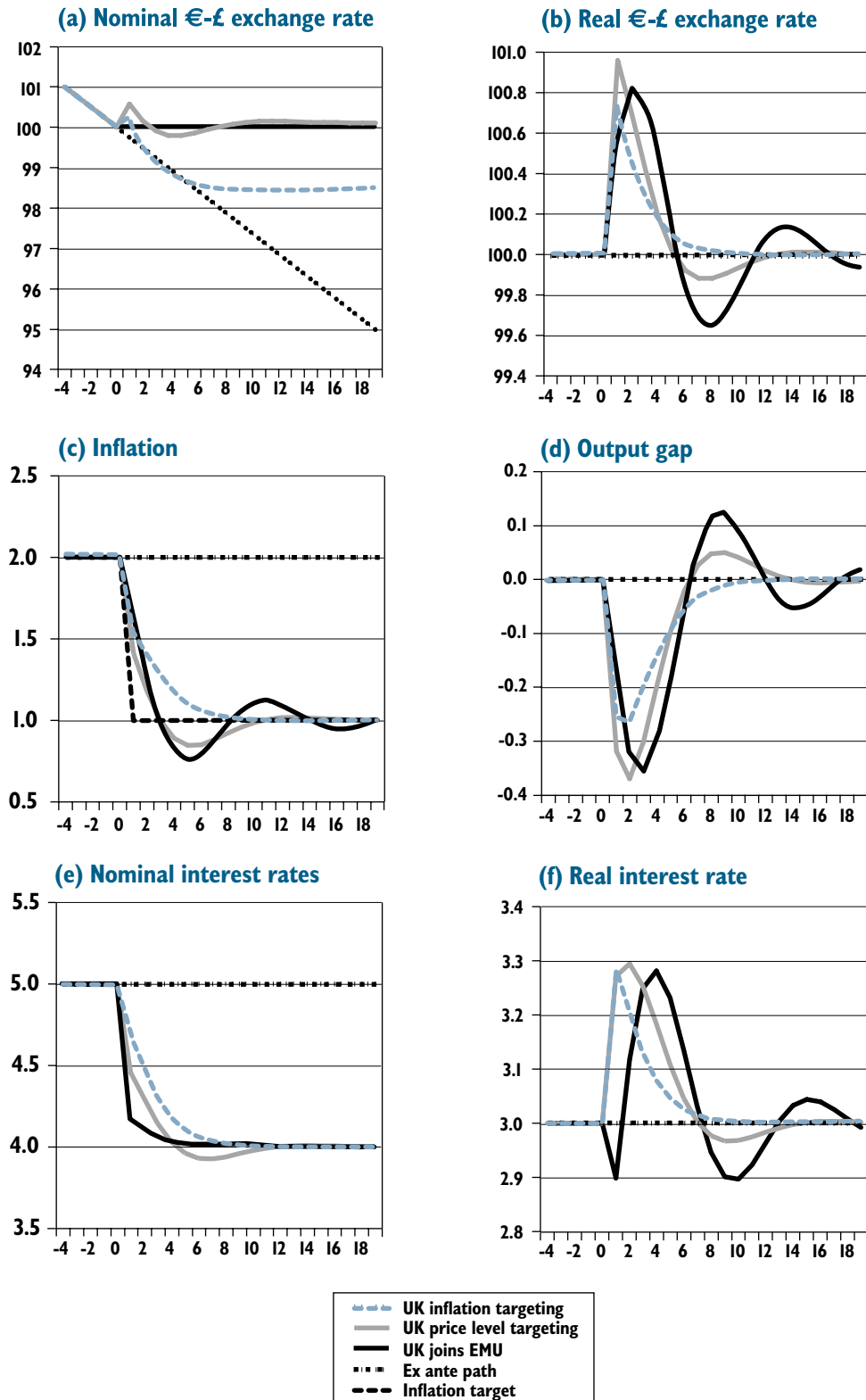
⁹ The analogy between EMU entry and price-level targeting is not exact to the extent that the euro area price level would respond slightly to the effects of the UK entering EMU, so the UK price level under EMU entry is slightly higher than under strict price-level targeting.

¹⁰ This potentially destabilising influence of real interest rates in a monetary union the face of asymmetric shocks is discussed in more detail in the EMU Study *Modelling shocks and adjustment mechanisms in EMU*.

¹¹ This approach to inflation reduction in advance of EMU entry was also suggested in De Grauwe (1992).

Chart 3.6: Stylised transition to EMU: Implied fall in UK inflation target from 2 per cent to 1 per cent under alternative regimes: inflation targeting, price-level targeting or entry into EMU

- Economies initially in equilibrium
- Inflation inertia present



Economies in disequilibrium; UK inflation target equals the euro area inflation ‘target’

3.29 So far, the analysis has focused on the principles affecting the transition problem for a country entering monetary union from a position of long-run equilibrium, except in so far as *ex-ante* and *ex-post* inflation rates differ. The analysis now goes on to explore the implications of the more general and perhaps more realistic situation where the UK and euro area economies are not in their respective equilibrium states at the point of EMU-entry announcement.

What drives disequilibrium?

3.30 It is important to understand why an economy might be away from its long-run equilibrium path for a sustained period. In particular, it is important to be able to explain why the real exchange rate might deviate from its long term equilibrium path.

3.31 The economy gets driven away from its long-run trajectory by shocks to demand and supply, or by shocks emanating from financial markets. And if these shocks are persistent, then the deviation of the economy from its long-run path may be similarly protracted. But how far should the economy be expected to deviate from its long-run path and what factors determine the size of this deviation? In the context of thinking about EMU entry, it is useful to distinguish between two separate influences:

- in an economy where wages and prices are **perfectly flexible**, any real shock is likely to necessitate an endogenous real response on the part of other variables, including relative prices. So for example, a demand shock may cause real interest rates, real exchange rates and the composition of demand to respond. But in these circumstances, with prices completely flexible, output would remain at its potential level and monetary policy could ensure that inflation is kept continually at target. This outcome is known as the ‘flexible price equilibrium path’: the responses of all real variables (eg output, real exchange rate) would be identical in or out of EMU.¹² But in a monetary union, it is not possible for all countries to achieve the inflation target in the face of shocks requiring equilibrating relative price changes. This will be shown to be important below when comparing the UK inflation response inside and outside EMU; and
- once it is additionally assumed that the responses of wages and prices display some **stickiness**, either due to structural forms of nominal inertia (e.g. menu costs in price setting, see Calvo, 1983) or due to the presence of fixed contracts in wage setting (see Taylor, 1980, Fuhrer and Moore, 1995), then economic theory predicts that the economy would remain away from its long-run equilibrium for longer than in the flexible price case. Now, deviations of inflation from its target path and non-zero output gaps can be expected as the norm. Different monetary policy strategies deliver different outcomes for output gaps and inflation deviations.

Flexible and sticky price equilibrium

3.32 In the context of considering membership of EMU, the distinction between disequilibrium arising under flexible and sticky prices is important both to issues relating to transition and more generally to issues relating to adjustment inside EMU. The flexible price or medium to long-term equilibrium value of all real variables (e.g. output, real exchange

¹² See Woodford (1999) for a fuller discussion of the flexible price equilibrium concept and Neiss and Nelson (2001) who focus on the concept of the equilibrium real interest rate. Piscitelli and Westaway (2003) examine the concept of a flexible price equilibrium real exchange rate in the context of NiGEM, the empirically based macroeconomic model to be used in Section 4 of this study.

rate) would be unaffected by the monetary policy regime in place, and so be invariant to whether the UK is assumed to be in EMU or not. But deviations around this medium to long-term equilibrium, arising as a consequence of inflexible wages and prices, vary according to the monetary regime in place. So different monetary policy strategies, including membership of EMU, result in different outcomes for the inflation-output trade-off. These issues are considered in more detail in the EMU study *Modelling shocks and adjustment mechanisms in EMU*.

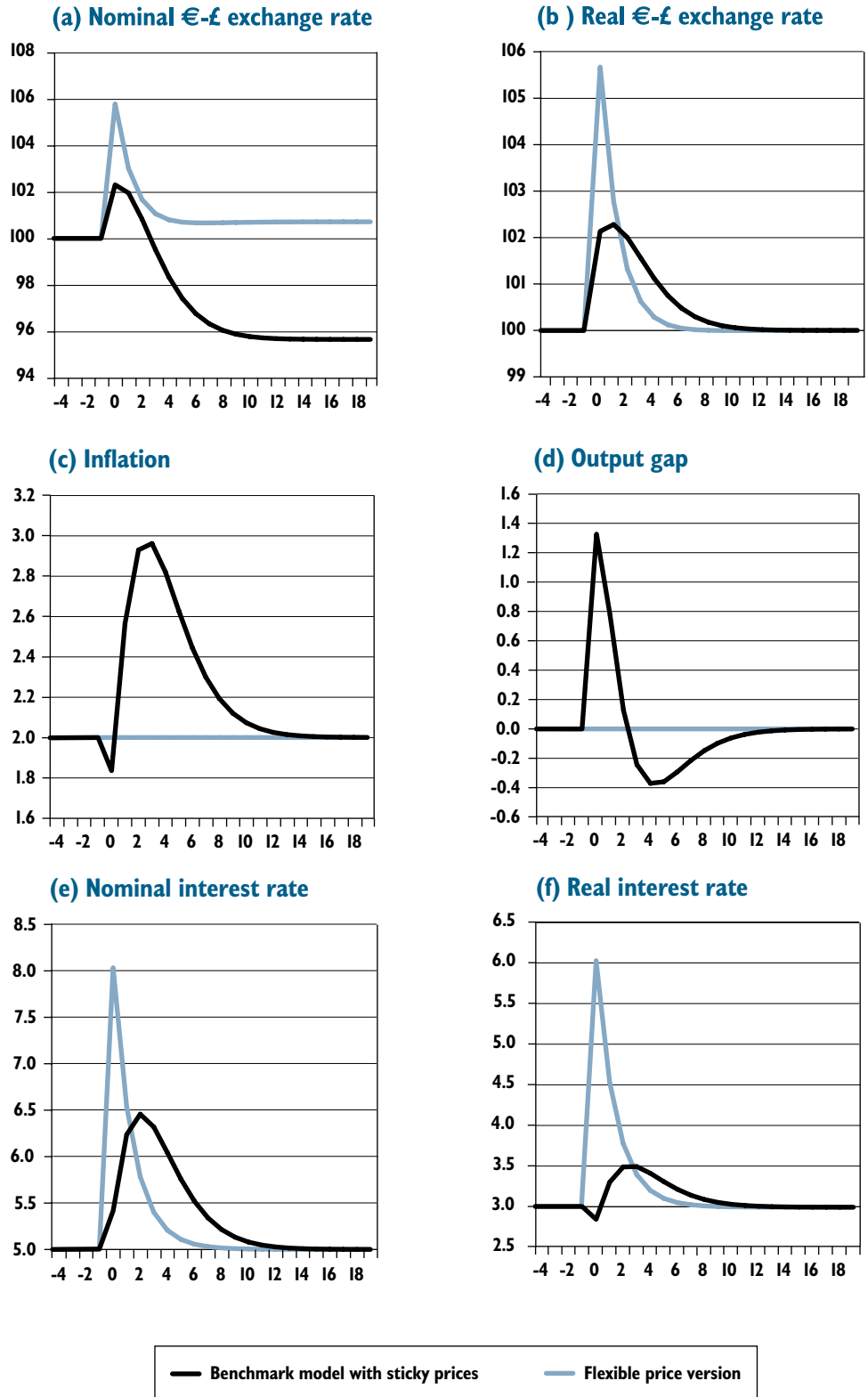
3.33 Charts 3.7(a) to (f) illustrate the response of the stylised model to a persistent UK-specific shock to demand, for example caused by an increase in the strength of consumer spending. Total demand is assumed to rise initially by 5 per cent before gradually dying out over five years.¹³ These charts show the responses under the assumption that the UK adopts a regime of inflation targeting outside EMU, comparing the flexible-price outcomes with those of the model where the effects of nominal inertia are included:

- output and inflation both rise in the conventional case, but are unaffected in the flexible price equilibrium;
- in both cases, the real exchange rate jumps in response to the demand shock, by 2 per cent in the sticky price case but by 6 per cent when prices are assumed to be flexible. This has the effect of crowding out net trade in order to offset the positive impulse to domestic demand;
- in the flexible price case, almost all of the real exchange rate adjustment takes place via movement in the nominal exchange rate;¹⁴ and
- demand is also dampened by an immediate sharp increase in real interest rates in the flexible price case (which is equal to nominal rates because of the perfect control of inflation at target). Given the UIP relationship, this higher interest rate is consistent with a gradual return to equilibrium of the real exchange rate.

¹³ The demand shock is assumed to dissipate with an autoregressive parameter of 0.5.

¹⁴ The small difference between the real and nominal exchange rate responses and the small long run nominal appreciation are explained by the induced movement in euro area prices which are not assumed to be perfectly flexible in the simulation.

Chart 3.7: 5 per cent persistent UK-specific demand shock outside EMU: comparison of flexible-price response with conventional sticky price response



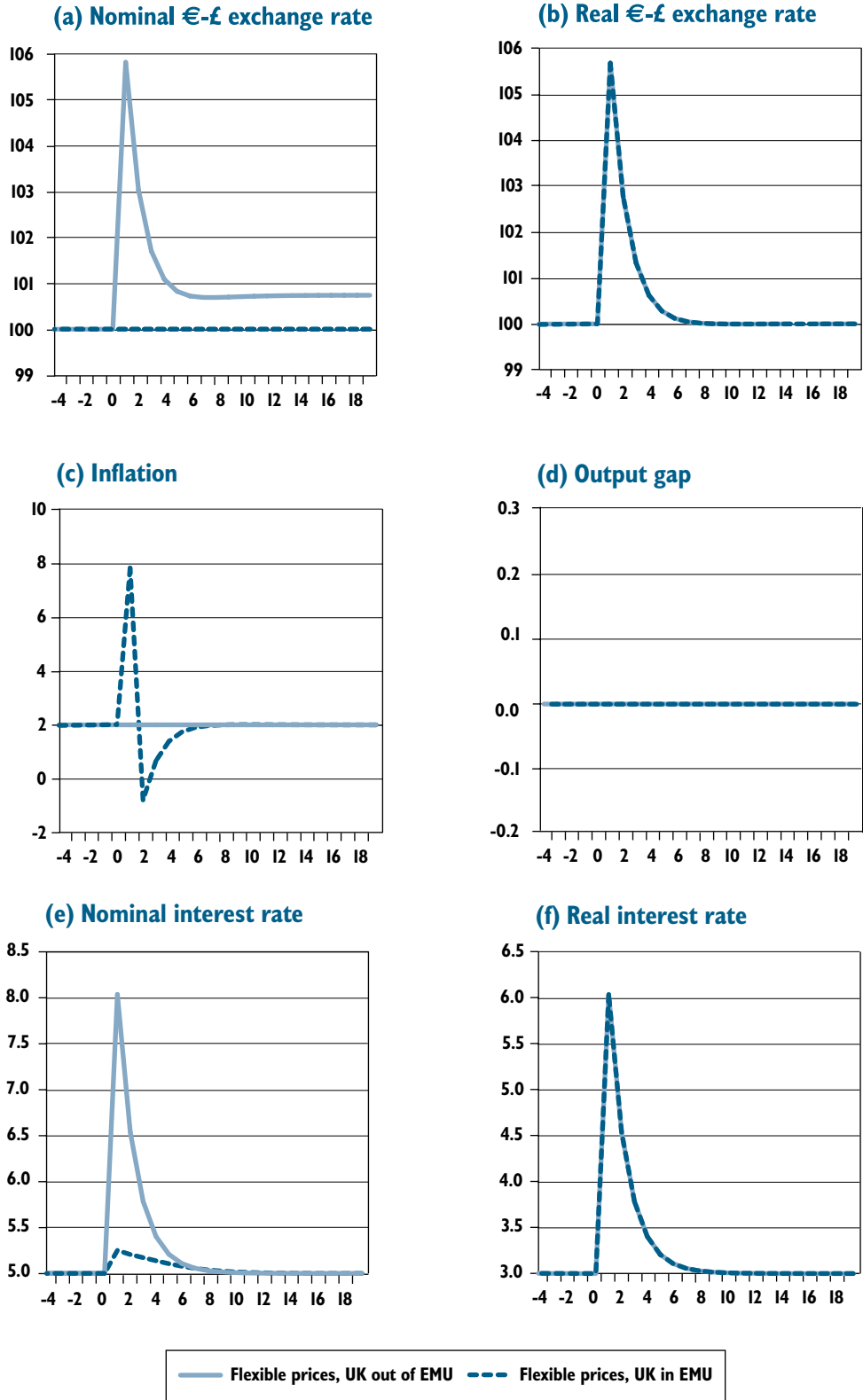
3.34 The key point here, in the context of EMU transition, is that the deviation of the real exchange rate from its medium to long-term equilibrium is not simply a symptom of price stickiness. It occurs under perfect price flexibility whenever the economy experiences temporary, albeit long-lasting, real country-specific shocks, in this case to demand.¹⁵

3.35 The importance of this point is emphasised if the flexible price responses of the economy to the country-specific demand shock inside and outside EMU are compared. Charts 3.8(a)-(f) illustrate. The relevant messages for the analysis of the transition are that:

- the flexible price responses of all real variables, that is output, real interest rates and, importantly in this context, the real exchange rate, are unaffected by the monetary regime in place. So the appreciation of the real exchange rate in the face of the asymmetric demand shock occurs whether the UK is in EMU or not; but
- the nominal responses are quite different comparing the outcomes inside and outside EMU. Since the nominal exchange rate between the UK and the euro area is necessarily fixed inside EMU, the required real exchange rate response must take place by means of relative price adjustment between the UK and the euro area. As a consequence, there is a sharp increase in UK inflation inside EMU to bring this about. Nominal interest rates similarly need to be much higher to bring about the same real interest rate path.

¹⁵ This contrasts with the flexible price responses for the earlier case when the inflation target was altered. In that case, because the shock was purely nominal, all real variables were unaffected.

Chart 3.8: 5 per cent persistent UK-specific demand shock: comparison of flexible price response when the UK is outside and inside EMU



Entry from position of disequilibrium due to 'fundamental' demand shock **3.36** The implications of announcing an intention to join EMU at a time when the economy is in the process of responding to this same asymmetric demand shock are now considered.¹⁶

3.37 The sticky-price model responses previously shown in Charts 3.7(a) to (f) can be taken as showing what would have happened if the UK had stayed outside EMU and will be referred to as the *ex ante* or baseline path:

- on this 'baseline path', within two quarters of the shock being perceived, the real exchange rate is some 2 per cent above its long-run equilibrium, and on a path back to equilibrium after two to three years;
- the demand shock initially causes inflation to be higher, by up to about 1 percentage point in the first year, gradually returning to target after about four years; accordingly
- the nominal exchange rate, having initially appreciated in the face of the original demand shock, depreciates over this horizon. This partly reflects the falling real exchange rate but mainly reflects the rising price level which eventually increases by around 5 per cent over the four-year horizon. This is important in understanding the results that follow. Although the real exchange rate returns to its equilibrium path, the nominal exchange rate outside EMU would settle down at a lower level in response to the demand shock. This is a simple consequence of the price level slippage inherent in an inflation-targeting regime.

3.38 Now consider the predictions of the model in the case where the UK is assumed to join EMU six months (i.e. two quarters) after the demand shock has hit and is in the process of working through the system. What nominal entry rate should be chosen? Here, two possibilities are simulated, although in principle any revaluation or devaluation could be chosen.¹⁷ Given the 'disequilibrium' of the real exchange rate relative to its long-run level:

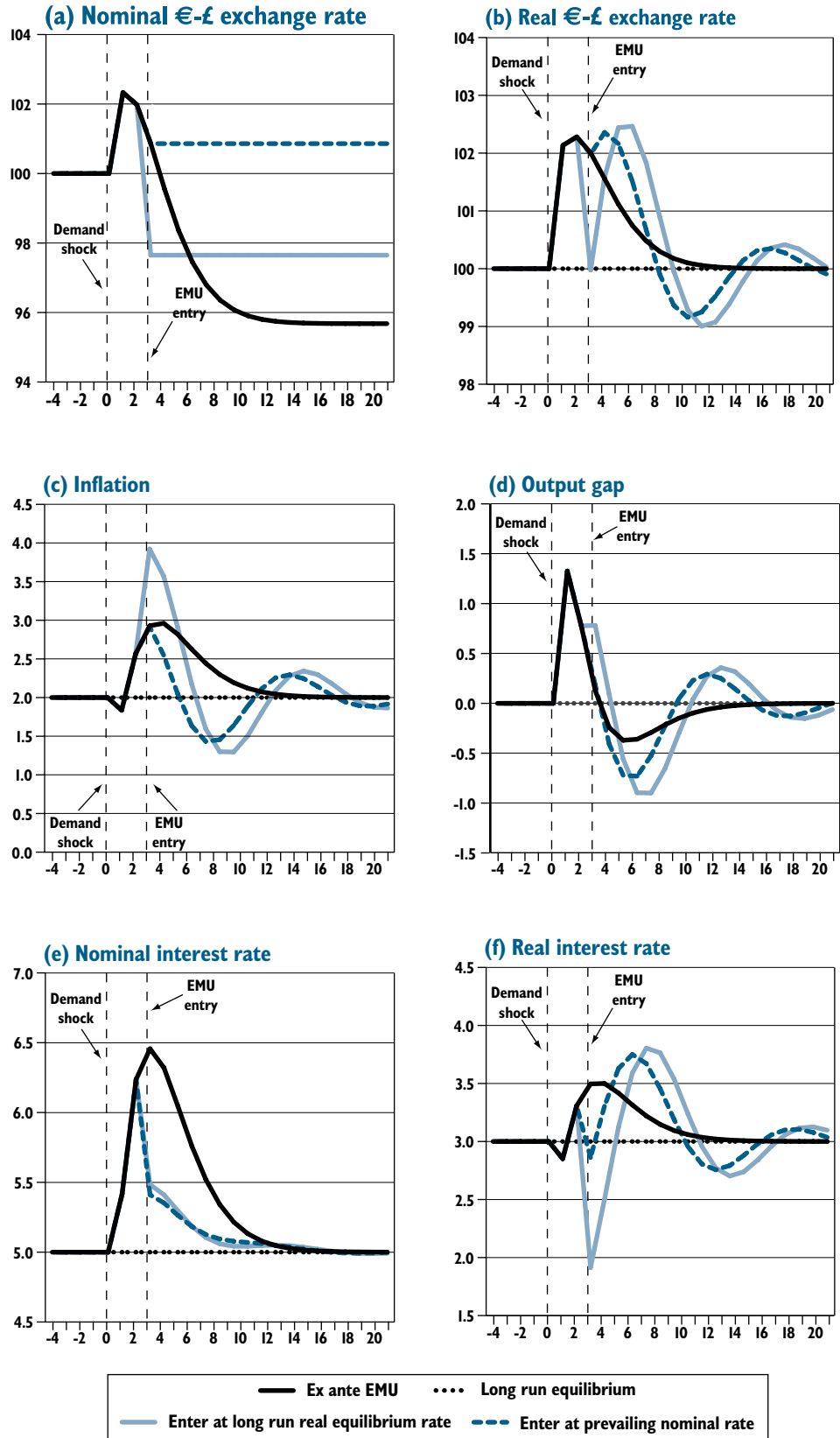
- i. the first case involves a nominal entry rate designed to eliminate the real 'disequilibrium' at the point of entry. This implies a 3.6 per cent depreciation relative to the baseline path, that is the path that would have occurred if the UK had stayed outside EMU;¹⁸ and
- ii. the second case involves a nominal entry rate consistent with the prevailing baseline nominal exchange rate.

¹⁶ This example of an asymmetric demand shock is not chosen completely arbitrarily because it has been suggested that the strength of sterling over the late 1990s may have been caused by this type of shock. For an extended discussion, see the EMU study *The exchange rate and macroeconomic adjustment* by HM Treasury.

¹⁷ In practice, the range of choice may be rather more proscribed.

¹⁸ This is more than the *ex-ante* 'disequilibrium' of 2 per cent since an additional depreciation is necessary to compensate for the increase in prices in the UK that would be caused by the immediate loosening of monetary policy on entering EMU.

Chart 3.9: 5 per cent persistent UK-specific demand shock: comparison of ex-ante EMU path with alternative EMU entry-rate scenarios

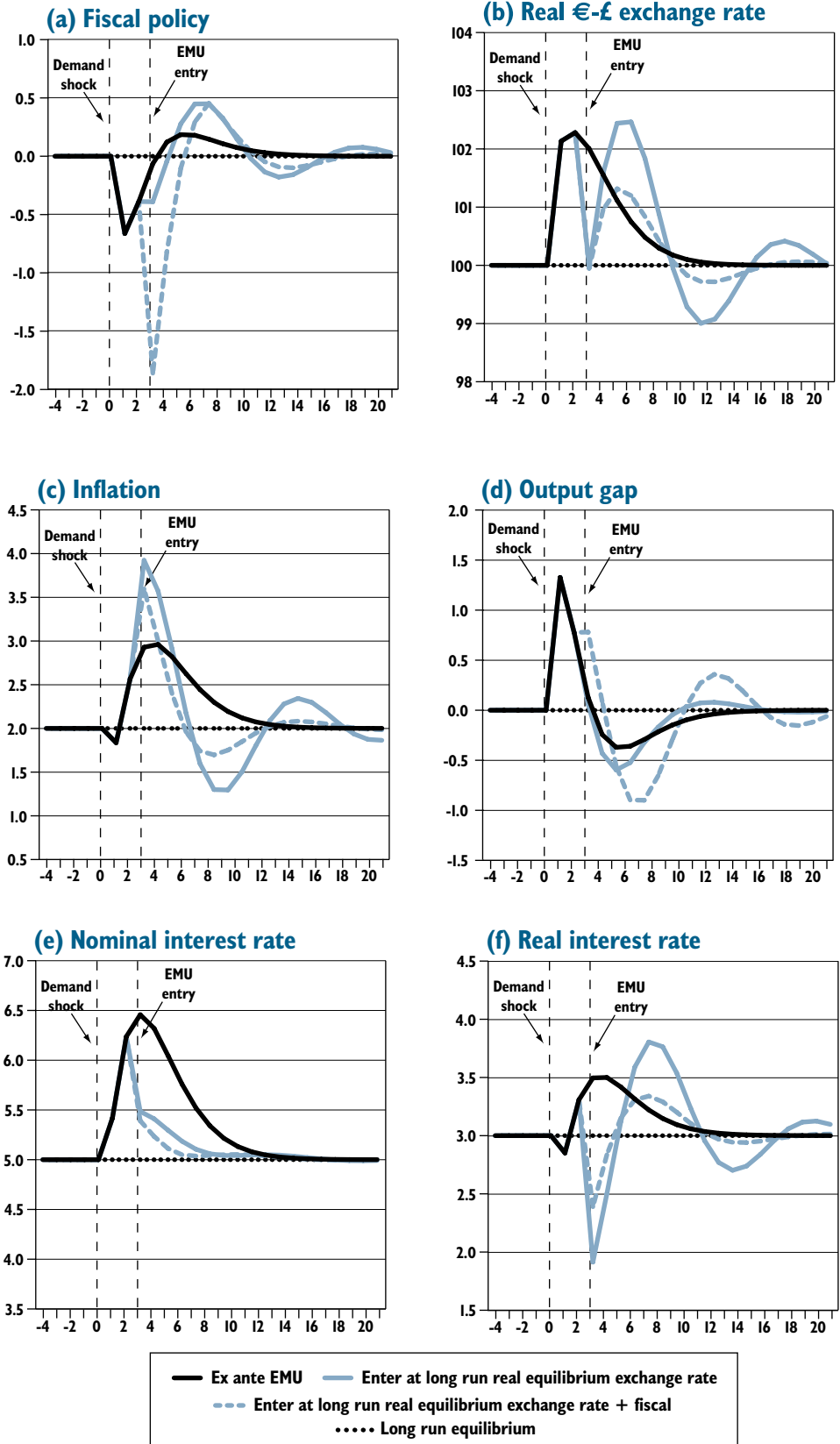


3.39 Charts 3.9(a) to (f) illustrate the effects, comparing them with the baseline path for the economy outside EMU. Vertical dashed lines are included on the charts to emphasise the date when the *ex ante* demand shock is assumed to hit and the date, two quarters later, when EMU entry is assumed to take place. A number of key points emerge:

- both EMU cases involve a higher nominal exchange rate in the long run than in the *ex ante* case (where the UK does not join EMU). This is because outside EMU, the independent monetary policy response to the demand shock would be to accommodate the temporary effects on the price level, lowering the nominal exchange rate over time. But if it were decided to lock into monetary union, the allowable increase in the price level would be much less because it would then be tied down by the price level in the euro area. So in the long run the implicit nominal exchange rate would be higher inside EMU than outside (see Chart 3.9(a));
- in the first EMU case, there is an immediate nominal devaluation of almost four per cent in an attempt to jump the real exchange rate towards its long-run equilibrium (see the light blue line in Chart 3.9(a)). But the effect is short-lived. By the middle of the first year, the real exchange rate is higher than in the *ex ante* case outside EMU (see the light line in Chart 3.9(b)). And in the second case where entry is assumed to occur at the current nominal exchange rate, the real exchange rate is immediately higher than in the *ex ante* case (see the dark dashed line in Chart 3.9(b)). The explanation for this is straightforward. The disequilibrium in the real exchange rate prior to entry is assumed to reflect an endogenous response to a positive real demand shock, and the need for such a real exchange rate response in the UK would not be obviated by joining a monetary union. Indeed, to the extent that interest rates in the UK would initially fall upon entry to EMU, the short-run real exchange rate would need to be even higher;
- inflation in the first year would be higher than in the *ex ante* case if entry were accompanied by a devaluation. But it would be lower if entry took place at the prevailing nominal exchange rate since the continuing depreciation which would have taken place in the *ex ante* case would immediately be halted upon the UK entering EMU (see Chart 3.9(c)); and
- the fall in output would be much larger overall in both the cases of EMU entry compared to the *ex ante* case. Where there is an initial devaluation, there would be a temporary increase in output relative to the *ex ante* case as the short-run real exchange rate fall had an effect, but this would be reversed by the end of the first year (see Chart 3.9(d)).

Fiscal policy modifies transition **3.40** It would be possible to modify the output-inflation trade off by the active use of **fiscal policy**, as shown earlier in Chart 3.5 for the case when EMU entry involved a fall in the implicit inflation target. Charts 3.10(a) to (f) compare the *ex ante* EMU case with EMU entry, first, as before, where the exchange rate is devalued to its long run equilibrium level and where only the automatic fiscal stabilisers are working; then, in addition, where this devaluation is accompanied by discretionary fiscal policy tightening (see the light dashed lines). In the previous case without active use of fiscal policy, this low entry rate caused inflation to rise immediately in order to bring the real exchange rate back up to its short to medium-term equilibrium. But with fiscal tightening, the warranted real exchange rate is lower over the short to medium-term, thus supporting the lower entry rate. As a result, inflation stays slightly closer to target (see Chart 3.10(c)) although output is further away from potential as a result (see Chart 3.10(d)).

Chart 3.10: 5 per cent persistent demand shock: comparison of ex-ante path with EMU entry at long run equilibrium rate, with and without fiscal policy action.



3.41 Of course, whether this scenario with tighter fiscal policy would be preferred in the transition to EMU would depend on policymakers' preferences. Indeed, even outside EMU, fiscal policy is available to modify the inflationary implications of the demand shock. It is possible to choose between these different outcomes by specifying policymakers' preferences in terms of a simple 'objective function'. This commonly adopted approach specifies in a stylised way how much policymakers value inflation deviations from target relative to output volatility,¹⁹ giving an overall valuation of the welfare (V) they derive from different combinations of output and inflation. For analytical simplicity, this is usually specified in a quadratic form as follows:

$$V = \sum_{t=0}^{\infty} \delta (\kappa_1(\pi_t - \pi_t^*)^2 + \kappa_2 ygap_t^2)$$

where κ_1 and κ_2 are respectively the weights on inflation deviations from target ($\pi - \pi^*$) and output deviations from potential, the output gap (ygap), and δ is the discount factor. It is beyond the scope of this study to attempt to specify a value for the relative weighting that policymakers place on inflation deviations relative to output stability. Table 3.1 gives details of the implied output and inflation costs of different entry scenarios, illustrating the implications of different entry rates and different fiscal strategies.²⁰

Table 3.1: Inflation and output costs of alternative entry rate scenarios in presence of ex-ante demand shock

	1	2	3	4	5	6
	<i>Ex ante</i> outside EMU	<i>Ex ante</i> outside EMU+ fiscal tightening	Entry at prevailing exchange rate	Entry at prevailing exchange rate+fiscal tightening	Entry at long run equilibrium	Entry at long run equilibrium +fiscal tightening
Inflation variability	3.15	2.03	2.26	1.15	8.68	3.95
Output variability	0.50	0.65	1.80	1.21	3.35	0.95

3.42 The results of Table 3.1, tabulated in this form, restate the results already described for cases of entering EMU from a position of real exchange rate disequilibrium in response to a real demand shock (as in Charts 3.9 and 3.10):

- without offsetting fiscal policy action, EMU entry would involve an improvement in inflation prospects relative to the baseline case outside EMU (in the sense of smaller deviations from target) if entry occurred at the prevailing exchange rate, albeit at the expense of greater output volatility (see column 3);
- if an attempt were made to use the occasion of EMU entry to engineer a devaluation of sterling to its long-run equilibrium level, then in the absence of fiscal action, the results point to higher inflation deviations from target and higher output volatility over the transition period. Indeed this would seem to be the poorest outcome amongst the cases considered on any weighting scheme (see column 5); but

¹⁹ Recent academic literature has suggested that this *ad hoc* form of objective function may be approximately consistent with policymakers maximising the welfare of the representative individual; see Woodford (1999). This issue is discussed in more detail in the EMU Study *Modelling shocks and adjustment mechanisms in EMU*.

²⁰ For these calculations, the variability of inflation and output is defined consistently with the expression for welfare (V) in paragraph 3.41 where the discount factor, δ , is assumed to be 1 per cent a quarter, while the finite time horizon assumed is fifteen years (starting at the point of EMU entry).

- the picture changes markedly once the possibility of compensating fiscal policy action is taken into account. As Charts 3.10(c) and (d) have shown, the model implies that fiscal tightening can reduce both inflation and output deviations inside EMU (although outside EMU, the reduction in inflation deviations only comes at the expense of greater output deviations). Whether these outcomes are to be preferred depends on whether fiscal policy is costless in terms of its economic effect and its political consequences and does not score in the policymakers' objective function.²¹

3.43 The preceding analysis has examined the problem of entering EMU at a time when the economy is faced with the need to respond to a real demand shock, irrespective of whether EMU entry occurs or not. One important point to emerge from this analysis is that, in principle, there is an implicit flexible price equilibrium where the response of the real economy to a real shock would be identical in or out of EMU. This emphasises that the real exchange rate is an endogenous relative price in the economy that is required to respond to movements in fundamentals. A simple demand shock was used to illustrate this case, but the principles involved apply to a wide range of shocks, including supply shocks and different types of demand shocks.

Entry from position of disequilibrium due to 'exchange rate' shock

3.44 There is one class of shock, however, which needs to be considered differently. This is where the nature of the shock itself would be affected by EMU membership. In this case, if entry to EMU occurred, then the shock itself could change, or even disappear altogether. The best example of this type of shock involves the risk premium on the euro-sterling exchange rate. Outside EMU, such a shock might cause the exchange rate to be 'misaligned' relative to real fundamentals. In that case, were the UK to join EMU, the source of the misalignment would disappear. This is quite unlike the case of the demand shock considered above where, even after EMU entry, the cause of the original exchange rate disequilibrium was still present.

3.45 Charts 3.11(a) to (d) illustrate the implications of joining EMU starting from an *ex-ante* position where, outside EMU, sterling is assumed to be *less* risky than other currencies, that is where the associated risk premium implies that interest rates on sterling-denominated assets can be two percentage points lower.²² Under this assumption, the lower real interest rate in the UK must be offset by the real exchange rate which needs to be just over 0.5 per cent higher to equilibrate supply and demand. Of course, this example may be somewhat unrealistic in the UK context. But even with these assumptions, there is still a small predicted 'misalignment' of the real exchange rate away from the long run equilibrium that would pertain in the absence of the risk premium.

²¹ These fiscal scenarios are only meant to be illustrative and are not intended to represent optimal fiscal policy responses. And they assume that discretionary fiscal policy action is both feasible and effective in the way that the model predicts. These assumptions are scrutinised more carefully in the EMU study on *Fiscal stabilisation and EMU*.

²² The monetary authorities are assumed to recognise that the equilibrium real interest rate needs to be two percentage points lower because of the risk premium and UK interest rates are assumed to be set accordingly lower.

3.46 Earlier it was shown how, in the face of a real shock, it would not necessarily be appropriate to join EMU by immediately moving the nominal exchange rate to its apparent long-run equilibrium, since the flexible price equilibrium real exchange rate was above its long-run equilibrium. Now the situation is different. Upon joining EMU, the ‘risk premium’ would immediately disappear.²³ This has the following implications for the transition:

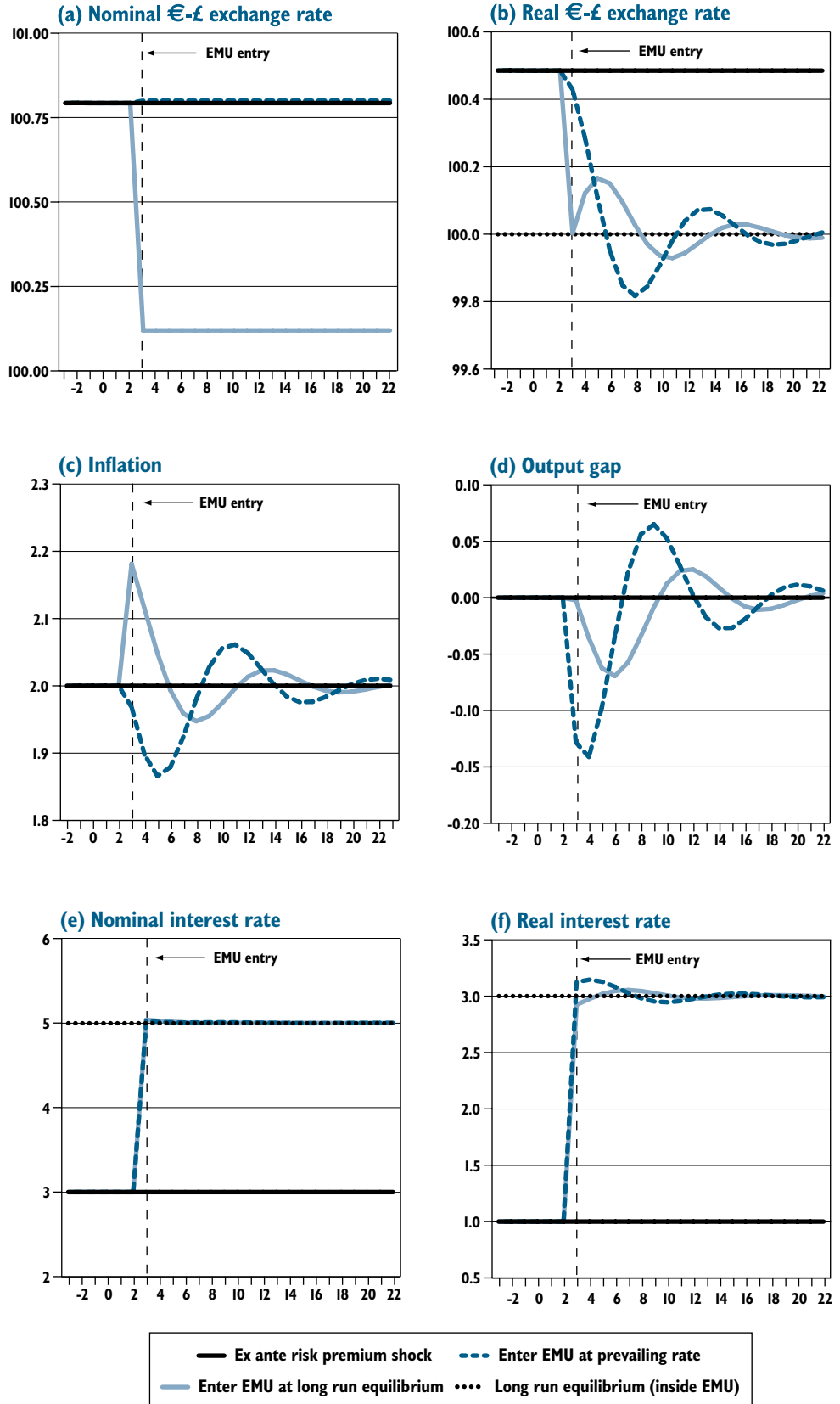
- the flexible-price real exchange rate would immediately return to the long run equilibrium. So, in an economy with flexible prices, the optimal strategy would be to enter EMU at that lower ‘equilibrium rate’ (i.e. at base levels of 100 in Chart 3.11 (b)); but
- with some inertia in the response of the economy, the situation would be more complicated because the economy would take a little time to respond to the new lower level of nominal interest rates. Even so, a policy of returning the real exchange rate to its long run equilibrium level gives rise to a relatively small fall temporary fall in output as firms and households take time to adjust to the fall in the required real exchange rate. And inflation rises by up to a quarter of a percentage point in response to the fall in the exchange rate;
- the alternative policy of entering EMU at the prevailing exchange rate gives rise to a much sharper fall in output but a correspondingly smaller increase in inflation; and
- Table 3.2 gives details of the associated costs in terms of inflation and output variability. This shows that output costs are smaller if EMU entry takes place at the long run equilibrating exchange rate rather than at the prevailing rate (comparing column 3 with column 2). Overall, too, the costs are smaller than those associated with transition in the face of an ongoing shock to fundamentals (as previously shown in Table 3.1).

Table 3.2: Inflation and output costs of alternative entry rate scenarios in presence of *ex-ante* ‘risk premium’ shock

	1 <i>Ex ante</i> outside EMU with risk premium shock	2 Entry at prevailing exchange rate	3 Entry at long run equilibrium
Inflation variability	0.00	0.15	0.14
Output variability	0.00	0.14	0.04

²³ An alternative assumption would be that, upon EMU entry, the euro takes on a proportion of the risk characteristics of the component currencies (where in our stylised model, the weight of the UK in euro area GDP is assumed to be 0.2). For ease of illustration, this approach is not adopted here, but it is in the stochastic simulations exercises carried out in the EMU study *Modelling shocks and adjustment mechanisms in EMU*.

Chart 3.II: 2 per cent risk premium shock: comparison of ex-ante path with EMU entry at prevailing rate, equilibrium rate and 'optimal' rate.



Conclusions from stylised model analysis

3.47 Some key insights emerge from the analysis of the stylised model, consistent with the predictions of standard economic theory:

- the transition to EMU from an initial position of equilibrium will be costless so long as the implicit inflation target inside EMU is identical to the UK's target outside;
- if the UK inflation-targeting regime implies a different 'target' inflation rate to that implied by EMU membership, then it would still be costless if prices are assumed to be perfectly flexible. But once inflation is more realistically assumed to display inertia, then the transition to EMU would involve inflation and output costs. Under these circumstances, it would be less costly to manage the transition to the new inflation target before entering EMU;
- immediate achievement of the long-run equilibrium exchange rate does not necessarily represent the best strategy when choosing the nominal conversion rate on entering EMU. The choice of entry rate will depend on identifying the source of any *ex ante* disequilibrium;
- the costs of the transition as modelled can be modified by more active use of fiscal policy;
- if the real exchange rate were away from its long-run equilibrium because it was appropriately responding to a real shock (such as a sustained increase in domestic demand), then it would still need to be so upon entering EMU. But inside EMU, the eventual return of the real exchange rate to its equilibrium would have to take place in terms of inflation adjustment. This may be more costly than if adjustment is allowed to take place outside EMU when the nominal exchange rate can facilitate adjustment; and
- if EMU entry were to be implemented starting from a position where, outside EMU, the real exchange rate was misaligned because of financial risk-premium effects, then the case for using the entry rate to force the economy back towards equilibrium would be much stronger.