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Monetary and Exchange Rate Policies of the Euro Area—Selected Issues

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MONETARY AND EXCHANGE RATE POLICIES OF THE EURO AREA

Selected Issues

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And G. Meredith (RES)

Approved by the European I Department

September 28, 2001

Contents Page

I. Estimating Potential Output and the NAIRU for the Euro Area [1]

A. Introduction

1. The identification of the euro-area's potential output and the associated non-accelerating inflation rate of unemployment (NAIRU) is an important empirical challenge. Knowledge of these unobservable variables allows policymakers to gauge the amount of existing inflationary pressure through the calculation of output and unemployment gaps. Modeling the behavior of the NAIRU in particular has taken on added significance as continued wage moderation in the face of rapidly falling unemployment and external terms-of-trade shocks has fueled speculation that recent labor market reforms and the start of EMU may have altered the wage formation process. This is an important issue for the ECB in its second pillar assessments of medium-term price pressures.

2. Modeling these concepts for the euro area, however, can be somewhat problematic. First, there is the question of data aggregation. To date, most work in this area has taken a bottom-up approach whereby potential output and NAIRU are estimated for individual countries that comprise the euro area and then added up to create an area-wide aggregate. A second issue is the correct econometric method and specification used to estimate and evaluate these unobservable variables. Recent attempts in an euro-area context have tended to focus on unobservable component-type (UC) models proposed by Apel and Jansson that consist of a system of equations organized around a standard Phillips curve framework. These models allow joint estimation of potential output and the NAIRU, while exploiting the mutual dependence inherent between output and unemployment. They also allow easy calculation of level and speed limit effects present in the economy. An additional difficulty has been the empirical specification of the unobservable trend components. A variety of authors have specified these components as random walks with stochastic trends (Mendez and Palenzuela (2001) and Fabiani and Mestre (2001)).[2]

3. The purpose of this chapter is to estimate the output gap and NAIRU in the euro area using area-wide aggregate data. After testing the integration properties of the data, we apply the basic Apel-Jansson UC systems model, which assumes potential output and the NAIRU follow random walks. The results suggest that although the implied output gap has closed considerably in recent years, by end 2000 a slight margin of slack still remained in the euro area. Moreover, the evolution of these estimates appears to be generally consistent with those found under a bottom-up approach used by many international organizations. Interestingly, the empirical estimates also indicate a substantial decline in the NAIRU since 1996, supporting the view that wage moderation has taken hold. In addition, the analysis highlights

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[1] Prepared by Kevin Ross, (KRoss@imf.org).

[2] However, this assumes I(2) behavior, implying that the change in unemployment or output is unbounded. Furthermore, as Laubach (2001) has pointed out, while many country's NAIRU can be modeled as an I(2) series, the resultant output gaps may not, in many instances, be sufficiently related to the inflation rate to be considered true NAIRU estimates.

the importance of correctly specifying supply shocks in a Philips curve framework and demonstrates that output gaps from a UC model can be a useful tool in forecasting inflation.

4. Section B describes the specifics of the UC model, while Section C discusses the data and integration issues. Sections D presents the results of the UC model and Section E discusses the outcome of a simple inflation forecasting exercise. Finally, Section F presents some conclusions and policy implications.

B. The Unobservable Components Model

5. In this section we lay out the Apel-Jansson reduced form model used in this study, which includes the following equations:

$$\Delta\pi_t = \sum_{i=1}^{I} \rho_i \Delta\pi_{t-i} + \sum_{j=0}^{J} \eta_0 (u_{t-j} - u^n_{t-j}) + \sum_{k=0}^{K} \omega_k z_{t-k} + \varepsilon_t^{pc} \quad (1)$$

$$y_t - y_t^p = \sum_{l=0}^{L} \phi_l (u_{t-l} - u^n_{t-l}) + \varepsilon_t^{ol} \quad (2)$$

$$u_t^n = u_{t-1}^n + \varepsilon_t^n \quad (3)$$

$$y_t^p = \alpha + y_{t-1}^p + \varepsilon_t^p \quad (4)$$

$$u_t - u_t^n = \sum_{m=1}^{M} \delta_m (u_{t-m} - u^n_{t-m}) + \varepsilon_t^c \quad (5)$$

where π_t is the log difference of the CPI, u_t the unemployment rate, u_t^n the NAIRU, z_t a vector of exogenous supply shock variables, y_t the log of real GDP, and y_t^p the log of potential output. All innovations in the system ($\varepsilon_t^{pc}, \varepsilon_t^{ol}, \varepsilon_t^n, \varepsilon_t^p, \varepsilon_t^c$) are assumed to be independent and identically distributed, as well as mutually uncorrelated, with zero means and constant variances. Note that values of α provide estimates of the growth rate of potential output.

6. The Apel-Jansson approach[3] allows joint estimation of the unobservable components—potential GDP and the NAIRU—as latent stochastic trends within a trivariate system of observables comprising information on unemployment, real GDP, and the change in inflation.[4] Identification of the system is achieved through Phillips Curve and Okun's Law relations (equations 1 and 2 above).

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[3] See M. Apel and P. Jansson, (1999a), "*System Estimates of Potential Output and the NAIRU*", Empirical Economics, 24:373-88 for details.

[4] Although the standard Philips curve is formulated in terms of the level of inflation, Apel and Jansson (1999a) demonstrate that in the presence of a unit root, the Phillips curve can be restated in terms of the change in inflation. Given that unit root tests on inflation were

(continued)

7. The introduction of the Phillips curve mechanism as an identifying restriction within the unobservable component system forces the estimated position of the NAIRU to depend on the actual inflation rate. Similarly, the Okun equation ensures that potential output and the NAIRU estimates will mirror each other. Thus the model takes into consideration the mutual dependency of output and unemployment through explicit co-variation restrictions on cyclical output and cyclical unemployment. In addition, the model includes a *z* vector of supply side variables in the Phillips curve equation[5]. With the inclusion of supply shock variables the estimated NAIRU is that unemployment rate which is consistent with constant inflation in the absence of supply shocks.

8. The specification of the system's (atheoretical) trend-cycle block (equations 3-5) follows established standards for decompositions in unobservable component models of this type.[6] In the model, the NAIRU is assumed to follow a random walk, while potential output is assumed to follow a random walk with drift. Other trend specifications for the main unobservable components (equations 3 and 4), such as a random walk with stochastic drift would require slight modifications in the transition equations. Finally, to close the model, the evolution of cyclical unemployment is assumed to follow an autoregressive process.

9. For purposes of estimation, the model is rewritten in state space form and the unknown parameters of the model and the time series of the UCs are found through application of the Kalman filter and maximum likelihood estimation. Specifically, a sequence of optimal predictions of the observable variables for a given set of coefficients and a sequence of unobservable variables is found through the recursive Kalman filter algorithm. Forecast errors of the observables are calculated and inserted into the maximum likelihood routine to compute optimal parameters and corresponding estimates for the NAIRU and potential output. The maximization of the log likelihood function is achieved by minimizing the sum of these forecast errors.

10. Theory dictates that the sum of the coefficients on cyclical unemployment in both the Phillips curve and Okun's law equations should be negative. In addition, the use of contemporaneous and lagged cyclical unemployment in the Phillips curve indicates that the unemployment gap may affect inflation through both level and change effects. This is revealed by rewriting the contribution of cyclical unemployment in the Phillips curve with

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inconclusive, the model was estimated in both level and change terms. The results were not materially different between either specification.

[5] A dummy variable is also included in 1998:4, representing the startup of Stage III of EMU.

[6] This atheoretical framework recognizes that information regarding the true structural determinants of potential output and the NAIRU may be limited. However, the use of supply shocks to identify cyclical components—and therefore the long run components—explicitly links potential output and the NAIRU to supply-side factors.

one lag:

$$\eta_0(u_t - u_t^n) + \eta_1(u_{t-1} - u_{t-1}^n), \tag{6}$$

as

$$(\eta_0 + \eta_1)(u_{t-1} - u_{t-1}^n) + \eta_o \Delta(u_t - u_t^n). \tag{7}$$

11. In the specification (6)-(7), level effects are captured by the sum of the coefficients $(\eta_0 + \eta_1)$ while "speed limit" effects are captured by the individual coefficient (η_0). As with the level effects, we would expect negative coefficient values, i.e. an unemployment rate above the natural rate should reduce inflationary pressures.

C. The Data

12. Quarterly aggregate euro area data on real GDP, prices, unemployment, and four specific supply shock variables over the 1973.1 to 2000.4 period have been constructed.[7] The four supply shocks are quarterly changes in relative real exchange rates, real oil prices, real import prices, and productivity.

13. Given the importance of the assumptions made about the non-stationary behavior of the unobservable components, the degree of integration in the unemployment rate and output series was tested. Real GDP is clearly an I(1) series, so the random walk with drift assumption is valid. Perron[8] unit root tests in the presence of structural breaks suggested that unemployment has a structural break—or shift in the slope of the trend around 1980—which causes near I(2) behavior. Thus we have decided to estimate the data over the this shortened sample, which covers the last two decades.

D. Model Results

14. A variety of estimates were obtained using consumer prices, a GDP deflator, and a wage inflation series. Given that the estimates for the NAIRU and the output gap do not significantly depend on the inflation series used, we will focus our discussion on outcomes using the consumer price inflation series. In most cases, diagnostics suggested the use of four lags of past inflation changes to eliminate autocorrelation in the residuals, however, the final model residuals also tended to exhibit some minor amount of non-normality and

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[7] We use an unemployment series that does not contain the recent corrections made by Eurostat. End-2000 unemployment was 8.8 percent under this series as compared to 8.3 percent in the Eurostat series.

[8] See P. Perron (1997), *"Further Evidence on Breaking Trend Functions in Macroeconomic Variables,"* Journal of Econometrics, 80:355-385.

heteroscedasticity in the unemployment and real GDP series. A general to specific modeling approach was used to determine lag lengths of the main supply shock variables.

15. In general, the results of the model are promising and in line with expectations.[9] Table 1 provides a selected set of statistically significant (at least at the 5 percent level) parameter estimates from the UC model using consumer price inflation rates. Level and change effects are negative as expected, with the coefficients indicating that a one percentage point change in the unemployment gap results in a 0.4 percentage point change in the inflation rate in the current quarter. The level effect implies that an unemployment rate of 1 percent above the natural rate for one year would decrease the inflation rate by close to 0.5 of a percentage point. From the Okun's Law relationship, the coefficients $(\phi_0 + \phi_1)$ indicated that each percentage point of the gap in unemployment can be associated with about a 1.7 percentage point of gap of output away from potential. Estimates of the trend growth rate of potential output α reveal an annual growth rate of around 2.4 to 2.5 percent—in line with current staff estimates. As expected, the sum of the four inflation lags implies a relatively high degree of price stickiness. Finally, the dummy variables on EMU points toward an upward shift in inflationary pressures under the regime change.[10]

Table 1. Euro Area: Selected Parameter Results

Variables	Parameters						
	η_0	η_1	ϕ_0	ϕ_1	α	$\sum\pi$	d_{emu}
Δcpi_t	-0.39	0.28	-5.60	3.95	0.62	0.80	0.20

16. Figure 1 contains three panels that presents estimates of the evolution of the output gap and NAIRU in the euro area. The top panel compares the estimates of the output gap emanating from the UC systems approach against some well known statistical filters. The results are similar in terms of dating turning points but differ in their estimates of the magnitude of the gap. The output gap under the Apel-Jansson methodology, shows large negative gaps—reaching some 3½ of potential during the mid-1980s and about 3 percent through most of the1990s—with a large positive output gap at the turn of the decade. The statistical filters, on the other hand, tend to place potential much closer to actual output, with relatively small negative gaps, and report various short periods of positive output gaps. The long period of negative output gaps under the model is not surprising given the declining trend of inflation over the last two decades.

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[9] An examination of the estimated inflation series suggested a well fitted model. In addition, the variances of the shocks to cyclical unemployment and the NAIRU were about ½ and ¾ of the shock to the variance of inflation, indicating that unemployment gaps explained a large part of the variance in inflation.

[10] Given the small number of post-EMU observations, the likelihood ratio statistic may not correctly identify the direction and magnitude of the true regime change. Thus, this coefficient may be just picking up the changed direction of inflation.

17. As seen in the second panel, inclusion of the conditional supply shock variables can impart very different gap estimates. The two gap estimates indicate that the supply shocks provided beneficial deflationary effects, i.e., output gaps estimated without the supply shock variables tended to lie below those that included these conditioning variables during the expansion and contractionary phases of the late-1980s cycle. The evidence from the current expansion indicates supply shocks are greatly affecting inflation changes, with estimated gap differences of about 1¾ percent by end 2000. This highlights the importance of correctly conditioning on a set of supply shocks which allows a more refined attribution of inflation to demand pressures.

18. To check if the Apel-Jansson methodology suffers from an end-point bias problem, we also re-estimate the model using data ending in 1997:4. Although the result (not reported here) suggested an absence of an end-point bias, estimating over different sample periods can result in slightly different historical estimates of the output gap.[11]

19. The final panel contains the actual euro area unemployment rate and the evolution of the estimated NAIRU, both with and without supply shocks in the model. Throughout most of the 1980s the estimated NAIRU (using CPI data with supply shocks) gradually increased, reaching 11 percent by early 1994 before drifting downward to about 10 percent in late 1996. However, since the start of the 1997 expansion, the NAIRU has fallen more rapidly, reaching some 8¼ percent by end-2000.

20. How do these results compare to the available set of estimates from international organizations? The first two panels of Figure 2 compare the model based estimates of the output gap and NAIRU from those provided by the WEO, the OECD, and the European Commission's databases. In addition, using the latest WEO assumptions we have forecast the output gap and NAIRU with the UC model. The OECD and the Commission estimate that the area-wide output gap has essentially closed by end-2000, with positive gaps opening up over the next two years. The IMF's WEO assumes a small negative gap in 2000 with overall balance reached by the end of 2002. The model based estimate appears to be in line with the WEO estimate, indicating that the gap could persist over the next few years with a further decline in the NAIRU.[12] Finally, the last panel of Figure 3 compares the estimated output gap with the annual rate of inflation in the euro area. As expected, the output gap from the model appears to be a good leading indicator of inflation, correctly anticipating four main turning

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[11] This is an important point. As discussed in Orphanides and Van Norden (1999), for a real-time output gap measures to be useful for monetary policy, they should not change much from their original estimate when additional information becomes available over time. Mendez and Palenzuela (2001) found that output gaps from an Apel-Jansson type models were consistent when applied to euro area data, i.e., real time and historical output gaps did not differ significantly.

[12] The somewhat larger implied differences in unemployment gaps versus the output gaps suggests that implicit estimates of the Okun coefficient may vary substantially.

points by about 3 to 4 quarters. It was also highly correlated—yielding a coefficient of about 82 percent—with other important activity indicators such as capacity utilization.

E. Inflation Forecasting Exercise

21. To provide a check on the informational content of the UC model output gap measure, a simple inflation forecasting exercise was undertaken using a standard Phillips curve:

$$\pi_t = \omega + \alpha(L)\pi_t + \tau(L)gap_t + \gamma(L)\Delta gap_t + \lambda(L)\Delta oil_t, \qquad (8)$$

with lagged values of the inflation, the output gap measure of interest and its first difference, and a relative oil price supply shock as a conditioning variable.[13] The change in the output gap has been inserted to account for speed limit effects, which may have a marked impact on inflation dynamics in a situation of rapidly accelerating activity. As usual, the level of the gap would indicate the overall state of inflationary demand pressures. In the exercise, output gaps from the UC model, a HP filter, and from a basic production function[14] were used for comparison purposes.

22. Using 1980.1 to 1997.4 as the estimation period, we construct 1-step ahead simulated forecasts of inflation over the next 12 quarters. One data point is added to the estimation sample, and the process re-run. Up to four lags of each of the regressors was considered in the specification of the inflation equation, thus resulting in 256 different specifications of this regression for each of the different output gaps. For each specification, the Theil U forecast statistic is calculated, namely the ratio of the root mean square error of the forecast under the model to the root mean square error for a "no change" or naive forecast. Values of this statistic greater than 1 indicate that the naïve forecast is superior to the regression specification. The results of the exercise reported in Table 2 confirm our prior that the output gap from the UC model does contain important information regarding future inflationary pressures.

F. Policy Implications and Conclusions

23. The results of our modeling exercise indicate that the NAIRU in the euro area has fallen substantially over the last five to six years. A falling NAIRU lends support to the notion that structural policy measures already implemented by euro-area governments have actually borne fruit. Encouragingly, movement toward peer review processes within policy making circles and comparable hard structural indicators have actually started to make a difference in area-wide labor market performance. Given that rigidity in labor markets

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[13] The specification follows Lown and Rich (1997).

[14] The production function estimates were calculated by following the methodology applied in the ECB's area-wide model, (see Fagan, Henry, and Mestre, (2001)).

usually goes hand in and with inefficient product markets, headway in reducing structural distortions in product markets—including cuts in state aids, implementation of the single market legislation, and liberalization of network sectors—may have also played a sizeable role in improving labor market outcomes.

24. The sizable degree of wage moderation in the face of sharp supply side shocks over the last few years suggests the possibility of a regime shift or structural change in the area's wage inflation process. If a regime shift has actually taken place, it may indicate that the partial hysteresis process in effect in many euro area countries in the 70s and 80s—whereby wage compensation claims bore a diminished relationship to underlying tightness in labor markets—may have started to unwind.[15] If the unwinding process has indeed begun, the monetary authorities' need to preemptively tighten at the onset of inflationary external shocks has—to some extent—been reduced by the efforts of policy makers to make the euro area economy more flexible.

25. There are a number of indicators that support the hypothesis of a (wage) inflation process under EMU which could be different from the past. For example, the structure of the euro area economy has gradually shifted toward employment intensive service sectors, which typically have less militant unions and are less likely to push wage demands in excess of productivity gains. Also, wage setters have undoubtedly recognized that the EMU regime change has eliminated the national exchange rate adjustment lever, by which uncompetitive wage increases could be adjusted through currency realignments. Although labor markets are far from integrated, wage setters may have come to take into account that capital is more mobile than in the past, a change that increases the importance of wage competitiveness within the area. All these factors point toward moderating wage pressures now and in the near future.

26. Regarding fiscal policy, the expansion in potential output and decline in the NAIRU loosens, ceteris paribus, the usual constraints felt by fiscal policy makers. A falling NAIRU translates into an automatic improvement in budget balances which could be used to finance tax cuts without affecting underlying balances. This implies a virtuous trade-off where by the resultant surpluses from a falling NAIRU are used to "purchase" further declines. In this regard, the need to stimulate positive effective labor supply responses argues for stressing a fiscal policy agenda which focuses on reforming labor taxation and benefit systems in a comprehensive manner.

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[15] Blanchard and Wolfers, (2000), suggest that as the effects of negative shocks—e.g., rising real interest rates and declines in total factor productivity—fade and as European labor market institutions improve, employment growth should pick up.

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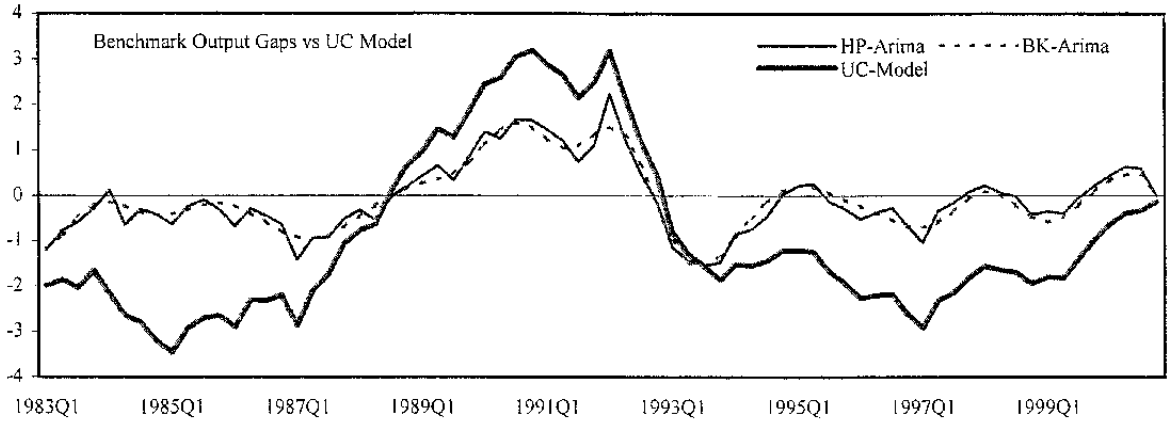
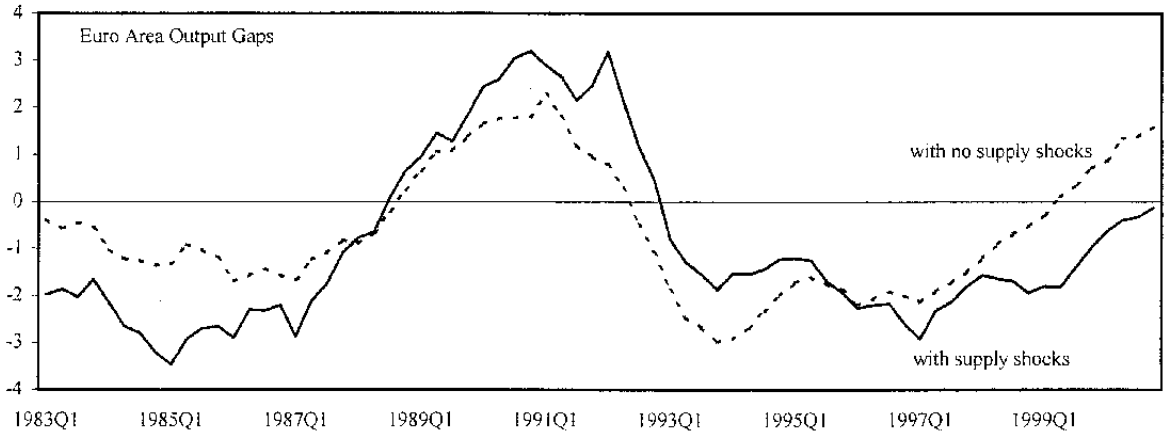
Table 2. Theil U Statistics from Inflation Forecasting Exercise 1/

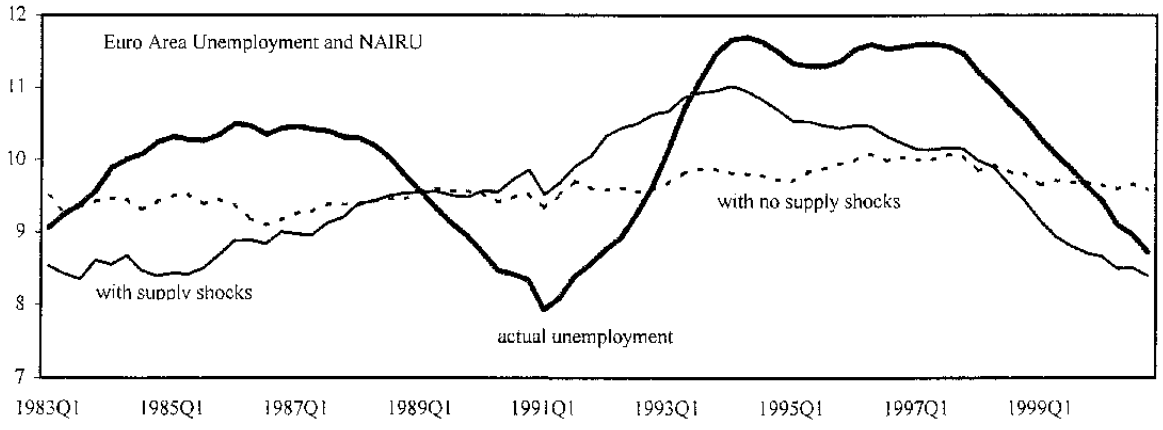
Steps	UC Model	HP-Arima	Production Function	UC Model	HP-Arima	Production Function
	Quarterly inflation changes			Annual inflation changes		
1	0.79	0.91	0.84	1.03	1.10	0.98
2	0.81	0.98	0.84	1.11	1.31	1.06
3	0.85	1.10	0.93	1.21	1.38	1.06
4	1.11	1.88	1.49	1.19	1.44	1.09
5	1.10	1.58	1.25	1.16	1.46	1.08
6	0.86	1.29	1.00	1.06	1.46	1.06
7	1.04	1.74	1.32	1.00	1.46	1.03
8	1.02	2.08	1.54	0.91	1.42	1.01
9	1.20	2.22	1.64	0.85	1.38	0.97
10	0.70	1.36	0.94	0.77	1.32	0.94
11	1.20	2.64	1.83	0.73	1.34	0.93
12	2.33	4.89	3.59	0.70	1.30	0.91
Average	1.08	1.89	1.44	0.98	1.36	1.01
	Change in annual inflation four quarters ahead			Annual inflation four quarters ahead		
1	1.03	0.98	0.98	0.96	1.01	1.05
2	1.26	1.03	1.03	0.98	1.00	1.12
3	2.00	1.23	1.23	0.93	0.88	1.47
4	1.71	1.07	1.07	0.88	0.89	1.29
5	1.98	1.12	1.12	0.89	0.87	1.38
6	2.05	1.12	1.12	0.88	0.82	1.44
7	3.23	1.71	1.71	0.82	0.79	2.09
8	3.05	1.57	1.57	0.81	0.76	1.94
9	2.72	1.43	1.43	0.77	0.74	1.77
10	4.00	2.31	2.31	0.84	0.83	2.76
11	1.94	0.83	0.83	0.80	0.80	1.16
12	1.09	0.34	0.34	0.69	0.72	0.72
Average	2.17	1.23	1.23	0.85	0.84	1.52

Source: Staff calculations based upon inflation regression equation (8) in the text.

Figure 1. Euro Area: Measures of Economic Slack

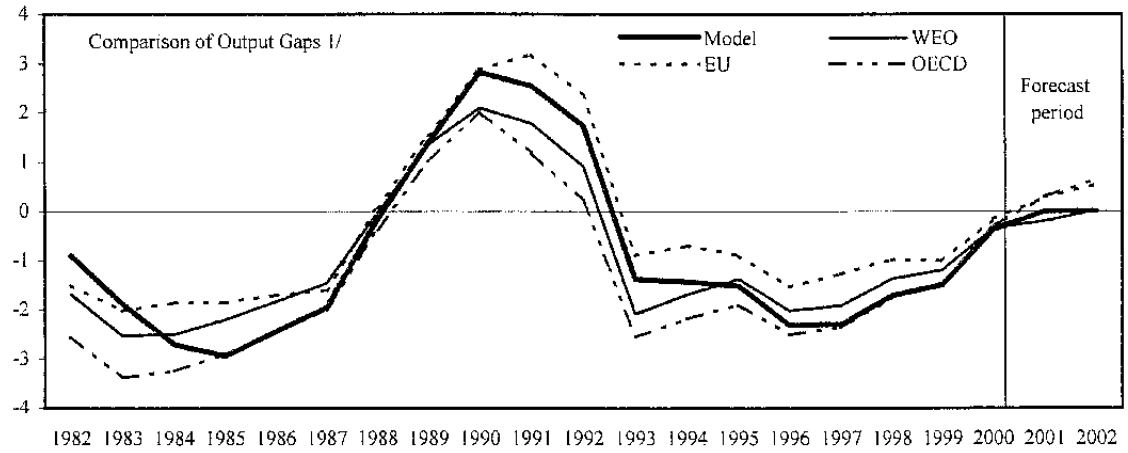


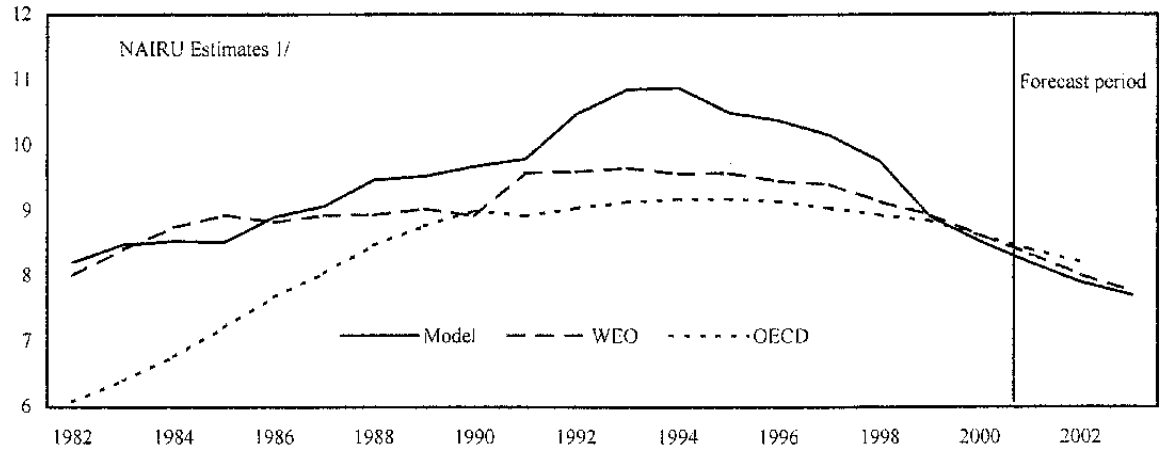


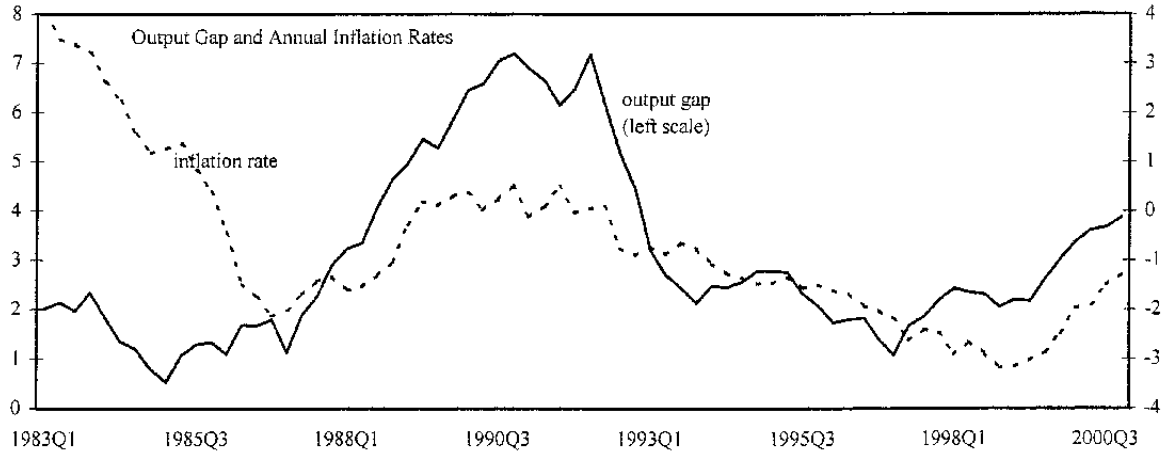


Sources: European Commission, OECD, IFS and staff calculations.

Figure 2. Euro Area: Comparisons of Slack Measures







Sources: OECD, IFS, and staff calculations.
1/ Annual data.

II. Why Has the Euro Been So Weak?[1]

A. Introduction

1. The decline in the value of the euro since its introduction in 1999 has been one of the most problematic aspects of the single-currency project. Not only has it been a source of popular concern in Europe, especially given already mixed enthusiasm for the new currency, but it has also complicated life for policymakers. The falling exchange rate, combined with oil and food price shocks, has fuelled inflation as real growth has weakened, constraining the scope for monetary easing. It has also raised the issue of whether exchange-market intervention is justified to correct for market distortions.

2. From an analytical perspective, the weakness in the euro is of interest in light of the energy devoted to predicting its future course prior to 1999. Although opinions were varied, the majority view seems to have been that the euro would more likely appreciate than depreciate. In any event, nobody appears to have anticipated the magnitude and speed of the decline, representing another inglorious chapter in attempts to forecast exchange rates.

3. Of course, explaining exchange rate movements ex post is less difficult than forecasting them, and there has been no shortage of rationalizations for the euro's decline. Initially, it was ascribed to a natural reversal of its strength in late 1998, and not viewed with great concern. As time passed, however, and the euro fell below 1997-98 lows, the search for more fundamental explanations began. This paper lays out and assesses many of the hypotheses that have been advanced for euro weakness. For the most part the analysis is conducted in terms of the exchange rate vis-à-vis the U.S. dollar. This comparison is emphasized for two reasons. First, the movement in the euro-dollar rate has been particularly dramatic, reflecting as it does a combination of both euro weakness and dollar strength against other currencies. Second, the market rationalization for these exchange rate developments often has involved a contrast between the structure and performance of the euro-area and U.S. economies.

4. The main points are as follows:

- Much of the weakness of the euro reflects the strength of the dollar against other currencies, which began prior to the introduction of the single currency itself. We associate this component with the surge in equity market capitalization in the U.S. since the mid-1990s, which led to a large positive demand shock and consequent currency appreciation.
- The second component reflects weakness in the euro against most other currencies beginning in 1999. This appears to reflect a change in capital market activity associated with the introduction of the euro. Specifically, issuance of euro-

[1] Prepared by Guy Meredith (Gmeredith@imf.org).

denominated debt by borrowers from outside the region surged, while euro-area borrowers replaced foreign-currency debt with euro issues. This shift was likely reinforced by euro-area lenders diversifying into non-euro assets. These shifts increased the supply of euro assets relative to demand, depressing the exchange rate.

- More recently, equity prices have corrected from peaks in 2000, creating scope for some reversal of euro weakness. Portfolio effects should fade over time, as asset stocks and international interest-rate differentials adjust.
- In the near term, though, these "fundamentals" may well be dominated by speculative market activity, as uncertainty about the underlying determinants of exchange rates has probably risen in the face of large observed movements in the euro/dollar rate.

5. The paper is structured as follows. The next section discusses past movements in the euro and estimates of its equilibrium level. The third section presents a conceptual framework for analyzing currency movements, while the fourth section reviews various explanations for euro weakness. The main hypotheses for euro weakness are presented in the fifth and sixth sections, involving the surge in U.S. equity valuations and shifts in portfolio behavior in the euro area respectively. The paper ends with concluding observations.

B. Review of Euro Movements

6. Figure 1 shows the nominal and real (CPI deflated) euro/dollar exchange rates since 1979. Prior to 1999, these are based on weighted averages of the legacy currency rates vis-à-vis the dollar. The series move closely together, reflecting the absence of a sustained inflation differential. It can be seen that the decline in the euro since early 1999 continues a trend that began in 1995. Since that time, the euro has depreciated by about 35 percent against the dollar. Against this underlying trend, the strength of the euro in late 1998 can be seen as a short-lived blip.

7. Looking further back, the value of the euro in 1995 was somewhat above its average of the previous 10 years, but not dramatically so (about 5 percent). Including the first half of the 1980s, the euro looks more appreciated in 1995, but exchange rates among the major currencies in the early 1980s reflected a significant overvaluation of the U.S. dollar, distorting the comparison. Indeed, the trough reached by the euro against the dollar in 1984 was almost 20 percent weaker than the mid-2001 rate, indicating that recent swings are not unprecedented by historical standards.

8. Another perspective on euro movements is provided by Figure 2, which shows the real *effective* value of the euro, and also the effective measure excluding the U.S. dollar and pound sterling. In real effective terms, the euro has depreciated by about 20 percent since 1995—slightly more than half as much as the decline in the euro/dollar rate. The smaller movement in the effective index, of course, reflects the strength of the dollar against other currencies, notably the yen. Indeed, the real effective value of the euro excluding the dollar and sterling was rather steady from 1995 to 1998, and only began to depreciate significantly with the introduction of the single currency in 1999. Since 1995, this narrower measure of

the effective rate has declined by about 10 percent. Taking this 10 percent decline as being the component that is specific to the euro, and removing it from the overall depreciation of 20 percent since 1995, leaves a component that reflects dollar strength of another 10 percent.[2]

9. Compared with the trough in 1984, the real effective value of the euro in mid-2001 is slightly higher, but the gap is less than for the euro/dollar bilateral rate. In any event, both measures indicate that the euro is well below normal historical levels, although the deviation is not as large as in 1984.

Table 1. Euro Weakness in Historical Terms
(percent change to first half of 2001)

	Real euro/dollar	Real effective (CPI)
1984 low	+17%	+6%
1986-95 average	-28%	-16%
1995	-34%	-19%
1999 (January)	-23%	-14%
Note: 2001 HI average euro/dollar rate = 0.873.		

10. Most empirical studies of the equilibrium level of the euro conclude that the currency is substantially undervalued from a medium-term perspective. As surveyed in Koen and others (2001), equilibrium estimates of the bilateral rate against the dollar are centered on a range of about $1.15-1.20 per euro, similar to the rate at which the euro was introduced. There are outliers, of course, with isolated estimates ranging from $0.87 per euro on the weak side to $1.45 on the strong side. On balance, though, there is a broad consensus that, at $0.85, the euro would be undervalued against the dollar by some 25-30 percent. Staff calculations based on a medium-term macroeconomic balance approach are consistent with these estimates: at mid-2001 exchange rate levels, the euro is judged to be undervalued against the dollar by over 25 percent.

11. This review of euro developments can be summarized as follows:

- the weakening in the euro against the dollar began in 1995 from a level that does not appear overvalued by historical standards;
- the euro remained broadly stable against currencies other than the dollar and the pound during 1995-98;

[2] This is consistent with the appreciation of the dollar against currencies other than the euro of about 25 percent over this period, which would translate into a decline in the euro's effective value of about 10 percent given the dollar's weight.

- since 1999, the euro has declined against most other currencies, as well as the dollar;
- of the 20 percent depreciation in the real effective value of the euro since 1995, about one half reflects the rise in the value of the dollar against other currencies, while the other half reflects weakness specific to the euro.

C. Conceptual Issues

12. A common difficulty in evaluating explanations for exchange rate movements is that the underlying framework is not clear. Explanations that are viewed as independent are often different aspects of the same phenomenon. Others involve theoretical inconsistencies, or the magnitude of the effect to be explained is at variance with conventional parameter estimates. Thus it is useful to start with a conceptual framework for assessing explanations for euro weakness.

13. Much of the difficulty in understanding exchange rates follows from their complex economic role. Exchange rates affect the relative price of domestic and foreign output, and thus trade competitiveness. They are also, of course, influenced by capital flows. Both the trade and capital account relationships, in turn, depend importantly on inter-temporal factors, including real interest rates. Real interest rates across countries reflect, among other things, expected real exchange rate movements. As a result, the determination of real exchange rates, real interest rates, and trade and capital flows is circular, and heavily dependent on views of the future. As expectations are inherently subjective, so are key factors determining exchange rates. The issue then becomes one of judging the plausibility of the implied expectations associated with a given level of the exchange rate.

14. These issues can be considered more concretely via an equation relating the expected change in the exchange rate to the interest differential on home- versus foreign-currency assets, and the expected "excess" return on home-currency assets:

$$er^{e}_{t,t+1} - er_t = -(i_t - i^{*}_t) + \varepsilon_t \quad . \tag{1}$$

The variable *er* is the foreign-currency price of domestic currency (thus an increase indicates domestic *appreciation*); *i* is the one-period interest rate on domestic assets; *i** is the rate on foreign assets, and ε is the expected excess return on domestic assets. This equation is an identity assuming that covered interest parity holds.[3] The expected change in the exchange rate and the interest differential can be expressed either in nominal or real terms, as equation (1) can be transformed from the former to the latter by subtracting expected inflation from both sides. Generally speaking, we will view this relationship in real terms.

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[3] Covered interest parity requires that the interest differential equal the gap between the forward exchange rate quoted in futures markets and the spot rate. The difference between the expected future rate and the forward rate then corresponds to the expected excess return.

15. Equation (1) presents problems in analyzing the determinants of the current exchange rate, as it includes the next-period (unobserved) expectation. This expectation is likely to be highly correlated with the current-period rate, and affected by similar factors. The next-period value can be iteratively substituted out, however, allowing the level of the exchange rate in some initial-period *0* to be expressed as a function of the initial interest differential and expected excess yield, the sum of their future values out to some distant point *T*, and the value of the exchange rate at that time:

$$er_0 = (i_0 - i_0^*) - \varepsilon_0 + \sum_{j=1}^{T}(i_j^e - i_j^{*,e}) - \sum_{j=1}^{T}\varepsilon_j^e + er_T^e \quad . \tag{2}$$

The advantage of this approach is that the expected value of the exchange rate at time *T* can more plausibly be assumed to be independent of cyclical and other transitory influences; this is particularly true when the equation is viewed in real terms.

16. Looking at equation (2), it is not surprising that it is difficult to understand exchange rate behavior. The only directly observable determinant is the current interest differential. The other right-hand side variables are unobservable, and in practice have an influence that vastly exceeds that of the current interest differential.[4] Things can be simplified somewhat, though, by assuming that long-term interest rates reflect expected future short rates, allowing the short-term differential to be collapsed into the current long-term differential:

$$er_0 = (il_0 - il_0^*) - \varepsilon_0 - \sum_{j=1}^{T}\varepsilon_j^e + er_T^e \quad , \tag{3}$$

where *il* is the long-term rate on assets of duration *T*.

17. Equation (3) suggests a "capital-flows-centric" view of exchange rate movements, as the exchange rate is a function of asset yields: it is not clear how trade considerations enter the picture. To close the framework, relationships are needed that relate the long-term interest rate to the exchange rate, and also determine the "terminal" exchange rate at time *T*. In a stylized way, these can be represented as:

$$y - \bar{y} = f(\overset{(-)}{er}, \overset{(-)}{il}, \overset{(+)}{y^f - \bar{y}}, z) \quad , \tag{4}$$

$$il = g(\overset{(+)}{y - \bar{y}}) \quad , \tag{5}$$

where y is a measure of economy-wide output, $\bar{y}$ is some potential level of y, y^f is foreign output, and z is a set of other factors that affect aggregate demand. These relationships are shown for the home economy; similar ones will apply to the foreign economy. Equation (4) indicates that output depends negatively on the exchange rate and the long-term interest rate,

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[4] The standard deviation of annual exchange rate movements among large industrial countries is, on average, five times greater than that of interest differentials (Meredith (2001)).

while (5) shows that the long-term rate rises when output increases above its potential level. There are more detailed stories that could be told to motivate these relationships—particularly the second—but they are not needed for present purposes.[5]

18. Trade flows affect the exchange rate in the short and medium run through their impact on output and thus interest rates. In the long run, when output returns to potential and long-term interest rates are equal across countries, the exchange rate is determined by solving equation (4) when $y - \bar{y}$ is zero. Demand factors, z, directly affect activity, and through this channel the interest differential, and then the exchange rate. What can broadly be described as "portfolio effects"—i.e., differences in expected yields on currencies—are incorporated in the ε terms. Finally, long-term fundamentals are captured in er_T^e, which reflects the long-run solution to equation (4).

19. How can the common view that differences in real growth rates between countries drive exchange rates be reconciled with this framework? Faster growth that reflects a positive demand shock (z) will boost output relative to potential, raising real interest rates. Higher real interest rates draw in foreign capital, causing the exchange rate to appreciate. Faster real growth that results from a shock to potential growth ($\Delta\bar{y}$) can also boost aggregate demand via higher investment and consumption, with similar effects on interest rates and the exchange rate. In the long run, however, the effect of sustained growth in potential output could well be the reverse: a higher level of $\bar{y}$ relative to y^f would require a depreciation of the exchange rate in order to equate global demand and supply for domestic output.[6]

20. The expected excess yield, ε, in equation (3) warrants some discussion. Differences between expected yields on assets can be attributed to some combination of imperfect asset substitutability and/or investor risk aversion. These are sometimes referred to as "portfolio effects", and can lead to a perverse relationship between interest rates and the exchange rate. For instance, an increase in ε will cause the exchange rate to depreciate, boosting domestic activity and interest rates—thus, the exchange rate will fall at the same time as interest rates rise. In practice, such portfolio effects are not directly observable because market expectations of the future exchange rate are not known. So their role in explaining exchange rate movements can only be inferred. An increase in the supply of assets denominated in the home currency, for example, will raise ε and depreciate the exchange rate if home and foreign currency assets are imperfect substitutes. An increase in exchange rate volatility would also affect ρ if investors are risk averse, but the sign of the effect is uncertain. Generally speaking,

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[5] A more detailed discussion of these conceptual issues is contained in IMF (1998). Adding sticky-price dynamics via an inflation equation would not alter the underlying story.

[6] As discussed in the next section, this effect depends on the source of the productivity shock. A shock concentrated in the traded-goods sector could instead lead to exchange rate appreciation via Balassa-Samuelson effects.

the risk premium will rise on the currency in which international investors have a net long position, as they reduce their exposure to currency fluctuations.

21. To summarize, this framework relates the current level of the exchange rate to current and expected future interest rates, exchange risk premia, and the long-run equilibrium value of the exchange rate. It shows why pinning down the causes of exchange rate movements is difficult—specifically, because these factors are largely unobservable. Nevertheless, the framework imposes useful structure by identifying the channels through which various factors play a role. The empirical plausibility of explanations can then be judged in terms these structural linkages, and their consistency with other macroeconomic phenomena.

D. Explanations for Euro Weakness

22. Many explanations have been advanced for why the euro is weak, which we categorize here under broad headings before a more specific discussion:

- initial conditions in the euro area (e.g. labor market rigidities);
- political factors (e.g. the Danish referendum);
- world oil price shocks;
- ECB policies (uncertainties, and/or an anti-growth bias);
- contrast with U.S. "new economy" (e.g. productivity growth);
- portfolio shifts (e.g. increased international issuance of euro-denominated bonds);
- nonfundamental market dynamics (e.g. herd behavior).

Initial conditions in the euro area

23. Structural weaknesses in euro-area economies are often perceived as undermining the currency. Examples are labor market rigidities; the size of welfare states; and difficulties in establishing sound fiscal policies. All of these features, however, are long-standing (de Grauwe (2000)). In order to explain the recent weakening of the euro, one would have to argue that there were unfavorable surprises that caused markets to become more pessimistic in the last few years. Yet the general picture has been one of continued progress in structural reforms in the euro area, and at a pace that is not unfavorable compared with past experience. So it is difficult to reconcile the timing of the weakness with these underlying factors.

24. This suggests a more provocative hypothesis: that structural reforms are actually bad for the euro. Looked at in terms of the theoretical framework, this view is at least as plausible as the conventional one. Structural reforms boost growth, but supply-driven growth does not unambiguously boost the currency. Indeed, in the longer term, the domestic currency is expected to fall in order that more domestic output can be sold abroad. In any event, while theoretically intriguing, this hypothesis is also implausible empirically. An appreciable impact on euro-area productivity growth would be needed relative to that in other countries for structural reforms to explain either a rise or fall in the currency. But there has been no such marked change in euro-area productivity growth.

25. Another initial condition is the possible overvaluation of the deutsche mark when the conversion rates of the EU-11 currencies were established. Germany was experiencing the after-effects of the positive demand shock arising from reunification at that time. To the extent that the strong deutsche mark was associated with a general overvaluation of the euro, one might argue that its subsequent weakness reflects a reversal of an initial misalignment. This view, however, is not consistent with the stylized facts, which suggest that the synthetic euro was not overvalued in 1995, when it began to weaken against the dollar. The deutsche mark itself was relatively strong, but this was offset by weakness in some other euro-area currencies following the 1992-93 ERM crisis. Overall, the synthetic euro was roughly in line with historical values.

Political factors

26. Some commentators have focused on *political events surrounding the future of the euro area* as explaining the weakness in the currency. Examples are the "no" vote in the Danish referendum on membership; the U.K. decision to continue to stay out; and general uncertainties about enlargement and the future size of the euro area. In this sense, the euro project as a whole is sometimes regarded as being incomplete in political as opposed to economic terms. The difficulty with these explanations is that there is no fundamental reason to expect them to be related to currency weakness. There is nothing inherent in the size of a region that determines its currency value. Small countries, such as Switzerland, can have strong currencies, as can large countries such as the U.S. In terms of the implications for monetary policy formulation, there is no presumption that including other countries would either weaken or strengthen policies. Of course, these political events have occurred in conjunction with the decline in the euro, but so have many other factors. If anything, to the extent there is causation, it seems more plausible to suppose that euro weakness has reinforced aversion to joining the area rather than the opposite.

27. The war in Kosovo and other disturbances in the Balkans have also been mentioned as justifying a flight from the euro for safe-haven reasons. The situation in the Balkans has stabilized, however. More fundamentally, the deutsche mark is a common safe-haven currency in eastern Europe. Political disturbances in the region might plausibly be expected to boost demand for "hard" deutsche marks and thus raise the value of the euro, rather than the reverse.

Oil price shocks

28. The decline in the effective value of the euro during 1999-2000 appears to correlate well with the surge in global oil prices (OECD (2001), Chapter IV). An inverse relationship is natural given that the euro area is a net oil importer and thus higher oil prices imply a negative terms of trade shock. How much of the euro depreciation could plausibly be explained by this factor? Model simulations suggest that only a small component of the euro weakness is attributable to the effects of higher world oil prices on trade flows. Hunt and others (2001) simulate the effects of a 50% rise in world oil prices, and find a depreciation in the real effective value of the euro of less than 2 percent; against the dollar, the euro falls by

only 1 percent. The absence of a large effect on the euro/dollar rate is not surprising, given that the net oil imports of the euro area were only slightly higher than those of the United States.[7]

29. Another facet of the story involves asset market effects associated with higher oil prices—specifically that oil exporters tend to recycle receipts into U.S. dollars rather than euros. Higher receipts then translate into higher world demand for U.S. assets, pushing up the dollar. No direct evidence has been produced on such an effect, however. Furthermore, two aspects of the experience tend to cast doubt on its importance. The first is that the portfolio shift and the associated dollar movements would be correlated with the cumulative flows of revenues of oil exporters, as opposed to spot oil prices themselves. The second is that the previous experience with global oil price shocks does not yield the same pattern of currency movements as observed in 1999-2000.

ECB policies

30. An often-cited view in markets is that opacity in ECB policy-making has undermined the currency. Changes in policy have sometimes come as surprises, with explanations that are perceived as unclear. Theoretically, policy uncertainty could have an effect through increased in the volatility of financial variables such as exchange rates and interest rates. To the extent that investors are risk-averse, such volatility could affect risk premia in exchange markets. The effect on the level of the exchange rate, though, is ambiguous. Volatility in a bilateral exchange rate, such as the euro/dollar rate, creates uncertainty for agents in both countries. In general, it will prompt them to reduce their exposure to currency movements by reducing their foreign-currency assets and liabilities. The net impact on the exchange rate then depends on the initial (net) exposures. If the home country is a net creditor in foreign assets, the home-country currency will tend to appreciate as uncertainty rises. Net foreign asset data indicate that the euro region is a net international creditor, whereas the United States is a debtor. Assuming this picture also broadly holds on a bilateral basis, greater exchange rate uncertainty would cause euro-region residents to reduce their U.S. dollar assets, and U.S. borrowers to reduce their euro liabilities. These portfolio shifts would cause the euro to appreciate, opposite to the conventional view.

31. Another factor conflicting with this view is the pre-1999 experience, when monetary policy in the euro region was guided by the Bundesbank. Like the ECB, the Bundesbank was widely perceived to be opaque and prone to surprising markets. Yet this was not viewed as contributing to weakness in the deutschemark, which instead was viewed as a notably "hard" currency. In a different context, uncertainty about movements in the yen/dollar rate seems to be a factor that has strengthened the yen by encouraging Japanese investors to keep their assets in yen, in spite of wide interest differentials in favor of foreign currencies.

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[7] Net oil imports of the euro area were about 0.7 percent of GDP in 1998 compared with 0.5 percent for the U.S.

32. Another school of thought is that ECB policy has generally been too tight. Tight policies, it is argued, have undermined future real growth in the region, in turn depressing the value of the euro. The converse is held to be true for Fed policy—by boosting U.S. growth, interest rate cuts have supported the dollar. If this were true, it would have important implications for policies. For instance, euro-area interest rate cuts could have a beneficial (short-term) effect on inflation by causing euro appreciation and lowering traded-goods prices.

33. However, this view is inconsistent with the pre-euro experience. The Bundesbank was widely perceived to be a conservative central bank with a pronounced anti-inflationary bias, yet the deutsche mark was a strong currency. Conceptually, it also encounters important difficulties. The first is that future growth, per se, does not influence exchange rates; rather, its impact is felt through changes in long-term interest rates.[8] Monetary easing that causes future growth to rise would have to cause long-term real interest rates to rise at the same time to explain exchange rate appreciation; monetary tightening would have to cause long-term real rates to fall. These effects are contrary to the expected impact of monetary policy on real interest rates, and also to the responses predicted by standard macroeconomic models.[9]

34. The actual experience is also not supportive. There were ten changes in the ECB's policy interest rate from 1999 through end-August 2001. Regressing the percent change in the effective exchange rate from the day before the policy change to six days after on the change in the interest rate yields a slope coefficient of 1.17 with a t-statistic of 1.6. This indicates that a one percentage point rise in the interest rate has been associated with euro appreciation of slightly over 1 percent, with the effect being marginally significant. The sign and size of the parameter are consistent with conventional stories of interest-rate effects.[10]

"New economy" phenomena

35. Many aspects of economic developments since the mid-1990s have been attributed to the birth of a "new economy." The new economy is viewed as arising from a surge in productivity growth due to factors such as the permeation of information technology, along with structural changes such as greater competition in product and labor markets. The persuasiveness of this view rose along with persistent upward revisions to U.S. GDP growth over this period, while inflation was generally lower than expected. The euro area, in

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[8] Growth could also affect the current exchange rate through its impact on the expected long-term real exchange rate. A monetary shock, however, would not be expected to influence long-term real variables, including the exchange rate.

[9] See, for instance, Bryant and others (1993).

[10] Similarly, regressing the change in the yield on index-linked French government bonds on that in the policy interest rate yielded a coefficient of 0.064 with a t-statistic of 1.3, indicating that real long-term interest rates tend to rise when monetary policy is tightened.

contrast, is viewed as lagging in these respects, explaining the difference in growth performance.

36. From an exchange rate perspective, there is indeed a correlation between revisions to projected growth for the U.S. and the euro area and movements in the euro/dollar rate (Figure 3).[11] As discussed above, this correlation could arise through interest rate channels. Faster productivity growth, for instance, can increase aggregate demand, both because investment demand rises and because households consume more in expectation of higher future incomes.[12] This demand effect will tend to push up real interest rates and thus the exchange rate in the faster growing economy, at least in the short run. In support of such a demand effect, there is evidence of a widening in long-term interest-rate differentials between the U.S. and the euro area. As shown in Figure 4, the gap between U.S. and German bond yields swung from about –25 basis points in the early 1990s to over 100 basis points by 2000.[13] The shift in spreads between U.S. treasuries and an aggregate of euro-area bond yields was even more pronounced, but this may reflect other factors, including declines in currency risk and inflation expectations in countries such as Italy. In any event, assuming that long-term inflation expectations were relatively stable, there appears to have been a significant shift in real interest differentials in favor of U.S. assets.[14]

37. At the same time as the interest rate differential widened in favor of U.S. assets and the dollar appreciated against the euro, the U.S. current account deficit rose sharply relative to that in the euro area (Figure 5). This combination of phenomena points to a substantial positive shock to aggregate demand in the U.S. relative to the euro area.[15] Furthermore, the restrained behavior of U.S. inflation in the face of an acceleration in output growth suggests

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[11] Corsetti and Pesenti (1999) appear to have first uncovered this relationship.

[12] Bailey and others (2001) have a lucid discussion of these effects in the context of a stylized model.

[13] The "adjusted" yield spread reflects the increase in the spread between yields on U.S. corporate bonds and treasuries, and is intended to adjust for the effect of a reduced supply of treasuries on market yields in 1999-2000 (see Schinasi and others (2001)).

[14] Measures of inflation expectations from consensus forecasts and, more recently, break-even inflation rates from index-linked bonds, suggest that longer-term expectations were indeed relatively stable over this period.

[15] These phenomena are also consistent with another facet of the "new economy" story: that high returns on U.S. investment have attracted foreign capital, driving up the exchange rate through capital account effects. Indeed, balance of payments data show a rise in direct investment by euro-area residents in the U.S. in recent years. Furthermore, empirical studies indicate a significant correlation between these capital flows and exchange rate developments (IMF (2001), Chapter II).

that this demand shock was accompanied by a positive supply shock in the U.S. The underlying cause could be a productivity growth shock, or some other factor that led to both higher demand and supply. These possibilities are analyzed in the next section.

38. A different explanation has been advanced for why productivity growth would affect the euro/dollar exchange rate that relies on long-run supply effects rather than short-run demand factors. Specifically, if faster productivity growth is concentrated in the traded-goods sector, and traded goods are perfect substitutes internationally, then the faster-growing economy should experience long-run exchange rate appreciation (the Balassa-Samuelson effect). In support of this story, Figure 6 shows a close correlation since the early 1990s between the lagged difference between euro-area and U.S. labor productivity growth and the change in the euro/dollar exchange rate.[16]

39. The Balassa-Samuelson explanation runs into problems with other aspects of the evidence, however. One is that the magnitude of the effect would need to be much greater than results obtained for other countries, with the euro/dollar exchange rate moving by over 3 times as much as the productivity growth differential. Typical estimates (and theoretical considerations) suggest that this ratio should be at most unity.[17] Using the upper limit for this ratio, Tille and others (2001) find that the Balassa-Samuelson effect could account for a depreciation of the euro against the dollar of about 1 percent per year during the 1990s. Starting from the mid-1990s, this would cumulate to about 5 percent by the end of the decade, compared with the actual depreciation of the euro against the dollar of 34 percent.

40. More fundamentally, the associated exchange rate appreciation would not undermine U.S. competitiveness. But the U.S. current account deficit has ballooned since the mid-1990s, and in a way that has been consistent with traditional trade relationships. Equilibrium estimates also suggest that the dollar has become highly overvalued. Finally, the Balassa-Samuelson story runs contrary to developments in real interest rates. Ongoing, expected real exchange rate appreciation should lower the real interest rate in the appreciating country in a world of high capital mobility.[18] Yet U.S. long-term interest rates rose substantially relative to euro-area rates over this period.

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[16] See Owen (2001).

[17] DeBroeck and Sløk (2001) find, for instance, an average response of the real exchange rate to GDP growth of 0.4 for non-transition countries. Bailey and others (2001) simulate a stylized model to derive roughly the same ratio of exchange rate movements to productivity changes.

[18] This is in fact what has been observed in Japan (Meredith (1998)).

Portfolio shifts

41. The introduction of the euro caused widespread changes in capital markets in the region (Galati and Tsatsaronis (2001)). Among these was the lowering of barriers to cross-border financial transactions, creating more liquid markets in euro-denominated debt securities than existed for the legacy currencies. One result was an explosion in the issuance of euro-denominated corporate bonds by issuers residing both within and outside the euro area. On the investor side, institutions within the euro area naturally switched to investments in euro assets from those in the legacy currencies. But the switch may not have been one-for-one, at least ex ante. Securities that were previously considered foreign assets in portfolios—because they were denominated in other legacy currencies—would be considered domestic-currency assets under the single currency. With unchanged portfolio guidelines on the allocation between domestic- and foreign-currency assets, funds would be "freed up" for investment in other currencies, such as dollars. In addition, there were changes to portfolio guidelines for some euro-area institutions (such as French pension funds) that allowed increases in the share allocated to foreign-currency assets. Finally, foreign investors have shown limited interest in acquiring euro-denominated assets, in contrast to the appetite of borrowers have in issuing them.

42. In the conceptual framework, these portfolio shifts would affect the exchange rate via changes in the expected excess yield on euro-denominated assets. Specifically, increased demand for borrowing in euros relative to the supply of investors' funds would raise the excess yield and depress the value of the euro. So the anecdotal evidence on capital market behavior is consistent, in principle, with the depreciation of the euro on a multilateral basis that coincided with its introduction. This story is pursued in more detail in Section VI, including an illustration of the impact of an assumed change in the excess yield on the exchange rate.

Nonfundamental market dynamics

43. De Grauwe (2000) explains the weakness of the euro since 1999 in terms of how markets form views about the factors driving exchange rates. Given great uncertainty about equilibrium levels of exchange rates, short-run movements tend to be driven by technical and chartist analysis. Sustained movements in one direction or another then lead to a search for fundamentals that explain these developments. Analysts selectively assess the evidence to find the appropriate fundamentals, leading to a self-reinforcing process. In the case of the euro, this led to an excessive focus on favorable aspects of the U.S. economy, even though such a view was not supported by observable news about the fundamentals taken as a whole.

44. This story is consistent with much other research on market dynamics that appears at odds with conventional views of rationality. Past experience (e.g. the dollar in the early 1980s and the yen in 1995) also suggests that markets can accentuate exchange rate movements through extrapolating recent developments in the absence of well-formed views of the fundamentals. The general premise is hard to dispute, given that there is no way of testing it directly—instead, it serves a role as a "residual" explanation when all other

identifiable factors have been exhausted. As discussed below, there are more fundamental reasons that may explain much of the depreciation of the euro against the dollar, leaving nonfundamental market dynamics as, at best, a supporting factor. But their relative importance may well become primary in the latter stages of currency cycles. The persistent weakness of the euro through mid-2001, in spite of a partial reversal of the equity-market based explanation for its weakness, could be consistent with this phenomenon.

E. Equity Markets and the Euro/Dollar Rate

45. As discussed above, macroeconomic developments since the mid-1990s point to the presence of positive demand and supply shocks in the U.S. economy relative to the euro area. What factors could explain such these shocks, and what proportion of the change in the euro/dollar rate could they explain? The explanation pursued here is the surge in U.S. equity prices since the mid-1990s, which raised market capitalization relative to GDP to unprecedented levels. Higher equity prices would boost both consumption and investment, explaining a shock on the demand side; higher investment would also raise the capital stock and thus labor productivity, increasing potential output on the supply side.

46. An immediate objection to this story is that the equity price surge in the late 1990s was not confined to U.S. markets. Prices rose in all developed markets: why would this lead to a disproportionate shock to the U.S. economy? There are three reasons for such an effect. The first is the huge rise in prices in new-economy companies, which are more important in the U.S. than other economies. As a result, broad measures of equity prices that include these share rose by more in U.S. markets (Figure 7). The second is that equity market capitalization in general is much larger relative to GDP in the U.S. than in most overseas economies, with the notable exception of the United Kingdom. U.S. market capitalization rose from about 80 percent of GDP in 1994 to 180 percent in 1999, an increase of 2¼ times (Figure 8). Capitalization of euro-area markets rose from about 30 percent of GDP to 90 percent over this period, rising 3 times. Thus, while the *proportional* rise in euro-area capitalization was larger, the increase *as a share of GDP* was 40 percent smaller than in the U.S (Figure 9). The third explanation is that typical estimates find a higher propensity to consume out of equity market wealth for U.S. households than those in most other countries.[19] A given increase in equity wealth relative to GDP would then result in a larger demand shock in the U.S. than elsewhere.

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[19] See Edison and Sløk (2001a). Theoretically, this phenomenon would be consistent with non-U.S. households having a lower discount rate on future labor income. Changes in financial wealth would then represent a smaller proportion of overall household wealth, implying a correspondingly smaller marginal propensity to consume out of wealth. More prosaically, U.S. equities could tend to be held directly by households, while in Europe equities may tend to be held more in trusts, pension funds, and indirectly through other financial intermediaries.

47. To assess the empirical importance of equity prices for exchange rates, equity market shocks were introduced into a two-region model that captures some key features of the U.S. and other industrialized economies. The model is based generally on relationships similar to those in the IMF's multi-country simulation model, MULTIMOD—a detailed description is available from the author. Here we summarize the aspects relevant to the simulations. The two regions are generally identical, with the following exceptions. The first is that the ROW is twice the size of the U.S., broadly consistent with relative shares in developed countries' GDP. Second, the U.S. has a lower leverage ratio, defined as the share of business-sector financing represented by debt versus equity. Specifically, both equity and debt in the baseline data are 80 percent of U.S. GDP, consistent with a capital/output ratio of 1.6. In the ROW region, the ratios are 30 percent and 130 percent respectively. Thirdly, U.S. households are assumed to have a higher discount rate on future labor income, which implies a higher propensity to consume out of financial wealth. In particular, the propensity to consume out of financial wealth for U.S. households is 0.05, while that for ROW households is 0.03. The exchange rate between the two regions is determined by uncovered interest parity, and thus reflects both the current and all expected future interest rate differentials.

48. To understand the simulations, it is useful to first describe the relationships that determine equity valuations. Equity prices reflect the discounted value of future profits accruing to equity holders. Profits are equal to the share of capital in after-tax GDP less depreciation and interest expenses. The discount rate is the sum of the risk-free real interest rate and an "equity premium" (ρ), with the latter defined as the excess rate at which investors discount future equity returns. The model incorporates forward-looking behavior, as expected profits are based on the model's projections for the relevant variables.

49. The nature of the equity premium is a source of controversy. Mehra and Prescott (1985) showed that the historical equity premium is much too large to be associated with compensation for risk in conventional consumption asset pricing models. As yet, however, a convincing alternative has not been advanced. Possible explanations for the historical size of the premium fall into two broad categories: those that are consistent with market efficiency, and those that are not. Examples of the former include utility-of-wealth functions with properties more exotic than those conventionally posited, or transactions costs unique to equity investing. The latter category includes misperceptions of the true risks of equity investing, or of future profit growth.

50. Several factors could have caused a decline in the equity premium in recent years. Transactions costs have fallen dramatically with the advent of internet brokers, while the development of low-load, index-linked mutual funds has allowed risk diversification at minimal expense. More abstractly, the end of the Cold War is sometimes mentioned as having diminished the risk of equity investing. In terms of market efficiency, the fact that equity returns have exceeded those on other assets has become increasingly recognized in light of popular discussion (e.g. Siegel (1994)). It also seems plausible that investor psychology has played a role (Shiller (2000)). To the extent that the above factors led to an initial decline in the equity premium, investors realized capital gains on existing assets,

reinforcing the perception that equities yielded excess returns. Confusion about appropriate valuations was further heightened by the view that the new economy invalidated traditional approaches to equity pricing. The presence of such a bubble is clear for technology stocks, which have already corrected dramatically. For stocks in traditional sectors, the situation is less obvious, and depends on the assumptions one makes about the equilibrium shift in the equity premium.

51. For the purpose of this analysis of past developments, explaining the equity premium is not of central importance. The premium itself does not appear in the model except in the equity valuation formula, and changes in it affect prices in a way that could arise from a variety of sources. A forward-looking assessment, in contrast, would clearly require a judgment as to the plausibility of the expectations that underlie equity valuations, and thus how equity prices might evolve in the future.

52. Looking back, the more germane issue is how large the shock would have to be in order to explain the surge in valuations in the second half of the 1990s. To assess this, a shock to the equity premium was phased in for both the US and ROW regions during 1995-2000 that generated profiles for market capitalization to GDP ratios similar to those in Figure 8.[20] Not surprisingly, these shocks had to be large to generate suitable changes in equity valuations. This is especially true because the direct impact on equity prices of a lower premium is partially offset by two factors. The first is higher risk-free interest rates caused by the boost to aggregate demand when equity prices rise. The second is lower future profit growth (per share) that results from the capital deepening associated with higher investment.[21] In the event, it was necessary to reduce the premia in both the U.S. and the euro area from baseline values of slightly over 5 percentage points to *negative* 4 percentage points by 2000, implying a total swing of 9 percentage points (Figure 10).[22]

53. The effects of this shock on relative market capitalization and the bilateral exchange rate are shown in Figure 11. The "capitalization gap" between the US and the ROW regions rises from 50 percent of GDP in 1994 to 90 percent in 2000, while the dollar appreciates by 23 percent over the same period. This compares with the 29 percent appreciation in the dollar's real effective value from 1994 to 2000. The exchange rate moves at the same time as

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[20] Beyond 2000, the shocks were calculated to keep the ratios of equity market capitalization to GDP constant at their new, higher, levels.

[21] This effect is discussed by Summers (1981) in the context of U.S. corporate taxation. He observes that equity values will rise by more when taxes fall if investors do not foresee the effects of capital accumulation on the marginal productivity of capital.

[22] The baseline value is similar to the 6.1 percent figure estimated for the U.S. by Mehra and Prescott for 1889-1978. Epaulard and Pommeret (2001) estimate premia ranging from 1.5 to 6.5 percent for France, judging the higher figure to be more representative.

equity valuations change, as all of the future effects of valuation changes are incorporated in the spot exchange rate under rational expectations. This differs from the actual experience, where the exchange rate lagged somewhat the equity valuation changes. This could reflect delays that are not incorporated in the model in recognizing the appreciating the impact of such changes on activity, real interest rates, and currency values.

54. Other aspects of the simulation are consistent with the stylized facts since the mid-1990s. For instance, the U.S output gap rises, and actual output increases by even more given the boost to potential from a higher capital stock (Figure 12). Yet the U.S. inflation rate is actually pushed down for several years, as higher labor productivity growth temporarily reduces growth in unit labor costs, and the strong dollar pushes down import prices (Figures 13 and 14).[23] The trade deficit widens by 2½ percent of GDP from 1994 to 2000, reflecting both the surge in domestic demand and the effects of a higher exchange rate on competitiveness, while the ROW records a surplus (Figure 15). For the ROW region, the shock is initially (slightly) contractionary, although capital accumulation pushes up both potential and actual output later in the decade. Inflation is slower to fall than in the U.S., however, because of the effects of the weaker exchange rate on import prices.

55. Short-term real interest rates in the U.S. do not begin to rise above their baseline values until late in the decade, as the impact of higher output and lower inflation on monetary policy are roughly offsetting (Figure 16). Long-term real interest rate move up sooner, however, reflecting the anticipated future impact of the positive demand shock. In the ROW region, the interest rate response is more muted, as the effects on activity are smaller. The differential between long-term real interest rates in the two regions rises from the baseline value of zero to almost 1 percentage point by 2000—a movement that, again, is consistent with the evidence.

56. Assuming that equity valuations stabilize relative to GDP at the levels observed in 2000, the exchange rate would peak in 2000 and gradually decline thereafter (Figure 17). The pace of decline is determined by the interest rate differential between the U.S. and the ROW; as this differential peaks at about 1 percentage point, the decline is very gradual. The exchange rate does not fall back to its initial level until 2040, after which it gradually asymptotes to a level that is about 8 percent below baseline. This long-run depreciation reflects the fact that the US output rises relative to ROW output given greater capital accumulation. As the two outputs are imperfect substitutes in global consumption, this requires a decline in the relative price of US output to equilibrate world product markets.

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[23] The simulated rise in U.S. labor productivity growth of about ½ percentage point per year is similar to Nordhaus' (2001) estimate an acceleration in U.S. productivity (outside the technology sector) of 0.54 percentage points during 1995-98.

57. The long-run paths of the other variables are, for the most part, not surprising. One notable feature, however, is the powerful effect on US inflation and unemployment of the eventual tapering off of the favorable shock to the equity premium. Even if the shock does not reverse, its stabilization leads to a significant rise in US inflation during 2001-2005. The reason is that exchange rate appreciation is no longer dampening import prices. At the same time, wage growth is relatively high, as wages are set against the background of the favorable productivity trends of the late 1990s and an unemployment rate that is initially below its long-term equilibrium level.

58. These effects, of course, depend on the model and its parameterization. Larger or smaller exchange rate movements can be obtained with alternative choices. In this respect, an important property of the model is the interest-sensitivity of aggregate demand, which depends both on the intertemporal elasticity of substitution of consumption and the elasticity of substitution between factors in production. The less interest sensitive is aggregate demand, the more interest rates must rise in the simulations to "crowd out" the increase in spending induced by higher equity prices. Larger interest-rate changes generally lead to larger exchange rate changes, given that the exchange rate is driven by interest differentials. In addition, model parameters were chosen to make demand relatively interest-rate elastic, thus preventing an implausibly large rise in real interest rates. Using alternative parameters that implied lower interest elasticities generated exchange rate movements in the range of 40 percent.[24] Working in the other direction, the results also depend on the assumption that the propensity to consume out of equity wealth in the U.S. is higher than that in the ROW. Setting these propensities to be the same resulted in a smaller exchange rate change of about 12 percent. The result in the baseline simulation of a 23 percent exchange rate change was typical of the middle range of effects obtained from several simulations with alternative parameter values.

59. The model can be used to assess an alternative explanation for the rise in equity values and the dollar, specifically that they reflect an acceleration in underlying U.S. productivity growth. Rather than lowering the equity premium, productivity growth was raised in both regions, but with a larger increase in the U.S. For illustrative purposes, trend productivity growth was raised by 1½ percentage points during 1995-2000 in the U.S., and by half that in the ROW. The results do not support a productivity-based story. In fact, higher productivity growth depresses, not raises, relative equity capitalization in the U.S. and the value of the dollar (Figure 18). The latter occurs because, in spite of a rise in the long-term real interest differential, more rapid expansion in U.S. output requires an ongoing decline in the real exchange rate.

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[24] The intertemporal elasticity of substitution in consumption was changed to ¼ from its baseline value of 1, while the production elasticity was changed to ½ from 1. With these values, the real short-term interest rate in the U.S. rises by 3 percentage points above baseline by 2000, as opposed to slightly over ½ percentage point in the base-case scenario.

60. The depressing effects of higher productivity growth on equity values may seem counter-intuitive. Higher productivity growth is often thought of as leading to higher profit growth, which would be discounted into higher equity prices. This effect does not hold in the simulation for two reasons. First, higher productivity boosts profit growth, but not profit growth *per share*. This is because higher output growth is associated with a faster rate of capital accumulation. Capital must be financed, and this requires issuing new shares or raising new debt. Either approach incurs costs to existing shareholders—owners of existing capital do not benefit from growth that is not accompanied by a rise in discounted profits *per unit of capital*. Secondly, discounted profits are pushed down because higher productivity growth requires a higher real interest rate. Investment needs to rise to maintain the same capital-to-output ratio when productivity growth increases; consumption also tends to rise, as future labor income is higher. Thus higher productivity growth leads, ex ante, to excess aggregate demand. The real interest rate must increase to equilibrate demand and supply.[25]

61. Offsetting these factors, higher productivity growth can raise equity prices by increasing rents accruing to existing capital when there are adjustment costs to putting in place new capital. These adjustment costs are reflected in the parameters on Tobin's q and on potential output growth in the investment equation; higher adjustment costs imply lower parameters. To test the sensitivity of the results to alternative values, the parameter on Tobin's q was cut in half and that on potential output growth was set to zero. Under these assumptions, the simulations show a small rise in equity values as productivity accelerates. Yet the effect on aggregate demand is too small to outweigh the depreciation due to an expanding relative supply of U.S. output, and the dollar still depreciates on impact. A pure productivity growth story, then, does not work as an explanation for dollar appreciation in this model.[26]

62. The paths for equity valuations and the exchange rate in the baseline scenario assume that equity premia in both the U.S. and ROW stabilize at negative values in the long run. While there may be sound reasons for a substantial decline in premia from historical levels, or even their elimination, it is harder to rationalize persistently negative values. The fact that negative premia are required to raise equity prices to observed levels in 2000 suggests an element of over-valuation in prices—although the subsequent correction would have narrowed it. To abstract from possible over-valuation, an alternative scenario was performed

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[25] The magnitude of the rise depends on the elasticity of substitution between capital and labor in production and the intertemporal elasticity of substitution. With logarithmic utility and Cobb-Douglas production technology, as assumed here, the steady-state real interest rate rises by the same amount as the increase in productivity growth.

[26] A two-sector framework that allowed for Balassa-Samuelson effects would be more likely to work in the right direction in terms of the exchange rate, but would encounter problems with other stylized facts, as discussed earlier.

where both equity premia were assumed to return to zero starting in 2001—5 percentage points below their initial value, but 4 above their long-run levels in the baseline scenario.

63. In this case, the equity capitalization gap between the two regions drops to about 75 percent of GDP in 2001 from 90 percent in 2000 (Figure 19). This is similar to the observed gap in the first half of 2001 following the correction in global prices. The drop in the exchange rate is more pronounced, as it declines to about 10 percent above baseline. This is at odds with recent events, as the euro weakened further against the dollar as equity prices fell. The discrepancy can be rationalized in two ways. First, the historical experience suggests a lag of about a year between equity price and exchange rate movements, in contrast to the model's prediction of a contemporaneous response. This may reflect recognition lags in markets, as discussed earlier. In this case, one might expect a delayed correction in the euro/dollar exchange rate in the foreseeable future. Alternatively, it could reflect other factors that are influencing the exchange rate. Among the possibilities, the next section discusses portfolio shifts in euro-denominated assets. A more general hypothesis is that markets have selectively chosen a set of fundamentals that rationalizes—and perpetuates—past dollar strength, along the lines of de Grauwe (2000). In this case, a turning point might only be realized when events decisively shift market sentiment.

64. Regarding the plausibility of the equity market story in terms of other major currencies, the yen has experienced massive gyrations in the 1990s that are not clearly related to equity prices. It seems plausible, however, that the Japanese economy has been hit by shocks, such as the problems in the financial sector and the Asian crisis, that have dominated those from equity markets. Studies also suggest that equity wealth has a limited direct impact on spending in Japan, thus one would not expect an important impact on the exchange rate. The U.K. case is perhaps more relevant. Equity market capitalization in the United Kingdom is similar to that in the United States, and rose by roughly as much relative to GDP (Figure 8). It is interesting, then, that the U.K. experience in the late 1990s was very similar, with the exchange rate appreciating sharply in the face of strong, domestic-demand led growth, and the current account deteriorating at the same time.

F. Portfolio Shifts

65. As noted earlier, the introduction of the euro caused a surge of activity in regional financial markets (Galati and Tsatsaronis (2001)). One of the most prominent developments was a sharp rise in issuance of euro-denominated debt relative to that in predecessor currencies (Figure 20). This rise was broad-based, reflecting activity by both resident and nonresident issuers. Resident issuers appear to have substituted away from foreign-currency denominated instruments as the domestic capital market became much more liquid with the advent of a unified approach to assessing issues in the single currency. In addition, nonresident issuers appear to have been motivated by a desire to establish a presence in a new and important market. International investors, in contrast, have shown limited interest in euro-denominated debt, and most of the rise in issuance has been absorbed by domestic investors.

66. Detken and Hartmann (2000) focus specifically on the international component of the increase in euro-denominated debt, defined as issuance by non-residents of the euro area. Their conclusions for this segment of the market are similar to those above. They observe a significant rise in the share of euro-denominated securities in the market as a whole during 1999, which came at the expense of both the dollar and the yen; the increase is even more pronounced when adjustments are made to compensate for movements in currency values. Figure 21 presents updated data using these concepts through the first quarter of 2001. Growth in the share of euro-denominated debt rose further during 2000 and early 2001, bringing it to 27 percent on a constant-currency basis by the end of the period compared with a stable ratio of about 17 percent in the pre-euro period. They also find evidence that the increased supply of euro bonds was primarily purchased by euro-area residents as opposed to outside investors.

67. Of course, the rise in euro-denominated debt issuance could have been caused either by an ex ante increase in the supply of debt by borrowers or in demand by investors. In the event, it appears that investor demand has not been the driving force. Firstly, there is the fact that little of the increased issuance was bought by international investors, in contrast to the activity on the borrowing side. For domestic investors, the market may have been made more attractive by the increased homogeneity and liquidity of euro-denominated issues. Constraints on portfolio allocation, however, would have worked in the opposite direction. Limits are common on the share of non-domestic currencies in institutional portfolios to contain exposure to exchange-rate risk.[27] While such risk would have declined among euro-area currencies prior to 1999, this would not have relaxed portfolio constraints without explicit action to redefine exposure limits. The introduction of the euro as a domestic currency automatically relaxed these constraints. The purchase of German bonds by a French investor, for instance, would now count as an increase in domestic-currency as opposed to foreign-currency assets. Thus, this redefinition had the effect of "freeing up" assets for investment in foreign currencies.[28]

68. The direction of these portfolio shifts—toward increased borrowing and reduced investment in euros—would put downward pressure on the currency. Conceptually, the value of the euro would fall until its expected future appreciation offset the initial factors that induced the portfolio shifts. Over time, the exchange rate would return back toward its

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[27] An example is French and Belgian pension funds, which are required by law to maintain at least 80 percent of their portfolio in domestic-currency assets.

[28] Another factor that could have caused a shift out of euro-area currencies is the exchange of deutschemark banknotes for dollars by participants in underground activities in eastern Europe. The hypothesis is that they would not want to exchange deutschemarks for euros through conventional channels at the time of the conversion in 2002. But estimates of the magnitude of these holdings suggest that they would not have a significant effect on the exchange rate.

original level, while the effects of the portfolio shift would be reflected in prices, asset stocks, and interest rates. A full treatment of these issues would require the specification and estimation of a portfolio balance model for global investment flows. Building portfolio models, though, is notoriously difficult given data limitations, simultaneity problems, and structural shifts. All of these issues would be relevant in the context of modeling the introduction of the euro. Instead, we adopt an indirect approach. This is to assume a shock to the "excess yield" on euro assets in the model used in Section V that would proxy for the portfolio effects of introducing the euro. While only illustrative, this exercise gives a feel for the magnitude and dynamics of the exchange rate change that would accompany such a shock.

69. The shock itself was assumed to be 20 basis points on the excess yield on ROW assets in 1999 and another 20 basis points in 2000 for a cumulative rise of 40 basis points.[29] This can be thought of a combination of the higher direct costs borrowers would pay to offset the advantages of issuing in euros, and the higher yield necessary to induce lenders to remain in euro assets. The effect of this shock on the exchange rate is significant, leading to a depreciation of the euro of 17 percent by 2000 (Figure 22). Over the long run, the exchange rate would gradually adjust back toward its initial level, while the interest differential between the two regions would widen to reflect the shock to equilibrium yields (Figure 23). The combination of the shock from equity markets described earlier and this hypothetical portfolio effect would account for a total shift in the euro/dollar of about 40 percent by 2000, similar to the actual experience.

G. Concluding Remarks

70. Many hypotheses have been advanced for why the euro has weakened in recent years. Some appear implausible on conceptual grounds, while others have encountered problems with the evidence as time has passed. In any case, it seems unlikely that any single cause can explain recent exchange rate movements among the major currencies, as they appear to reflect phenomena specific to both the U.S. and euro-area economies.

71. This paper identifies two factors that are theoretically consistent with observed exchange rate movements, and also the broad macroeconomic effects that have accompanied them. The first is the surge in global equity values since the mid-1990s, which resulted in a shock that disproportionately affected the U.S. economy. Not only the rise in the dollar against most other currencies, but many other aspects of the "new economy," are consistent with this shock. The second is the shift in portfolio behavior that accompanied the introduction of the euro. Available evidence points to a surge in issuance of euro debt by borrowers, and a shift toward non-euro assets by lenders. While the effects are hard to

[29] For this shock the relative size of the two areas was reversed so that the ROW, now interpreted as the euro area, accounted for 1/3 of total output.

quantify precisely, illustrative simulations suggest that they can plausibly explain the component of euro weakness that coincided with its introduction.

72. Looking ahead, these factors are unlikely to intensify. Indeed, the (partial) correction in equity prices since peaks in 2000 should work in the opposite direction, creating scope for some reversal of the euro weakness. Similarly, the portfolio effects associated with the introduction of the euro are likely to have be strongest in the early stages, when the latent gap between supply and demand for euro assets was largest. As portfolio allocations adjust over time, and international interest rate differentials shift to accommodate the shift in asset demands, the exchange rate effects should diminish.

73. As far as economic policies are concerned, the explanations advanced here for euro weakness do not suggest a direct role for policies as a corrective tool. Clearly, though, the weak euro has had implications for activity and prices in the euro area, and these have influenced policy formulation. If, indeed, the fundamental forces that have driven down the euro are beginning to unwind, an important factor behind the shocks to euro-area inflation would reverse, allowing scope for greater monetary easing.

74. At the same time, the importance of speculative market forces should not be downplayed, especially against the background of large, unexpected currency movements. Historical experience, for instance with the yen in 1995 and 1998, suggests that market uncertainty about fundamentals is magnified by past volatility. In addition, there is the question of the factors driving equity price movements. It remains open to question how much of the run-up in equity prices has been driven by a shift in equilibrium yields on equities versus "irrational exuberance" about future earnings growth. If market expectations have become distorted, equity prices could be vulnerable to a much larger adjustment that yet observed, with consequent implications for exchange rates.

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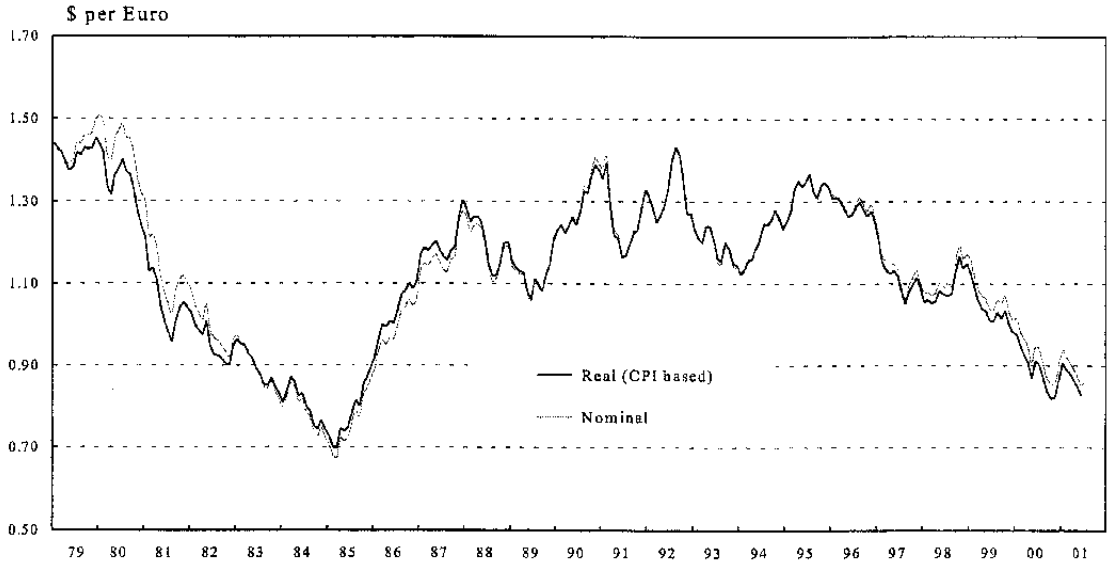
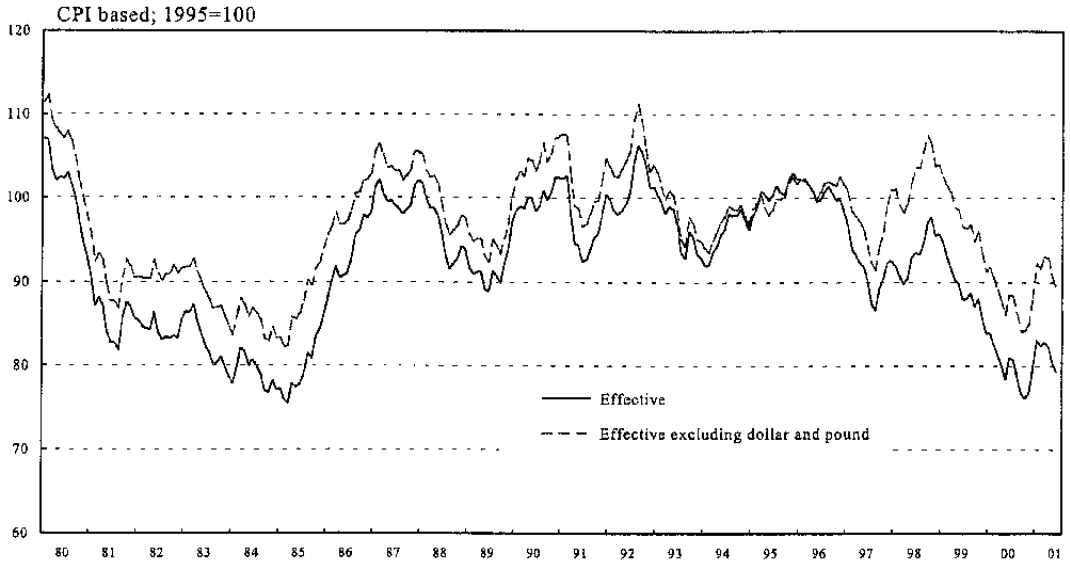
Figure 1. Real and Nominal Euro Rates Versus U.S. Dollar



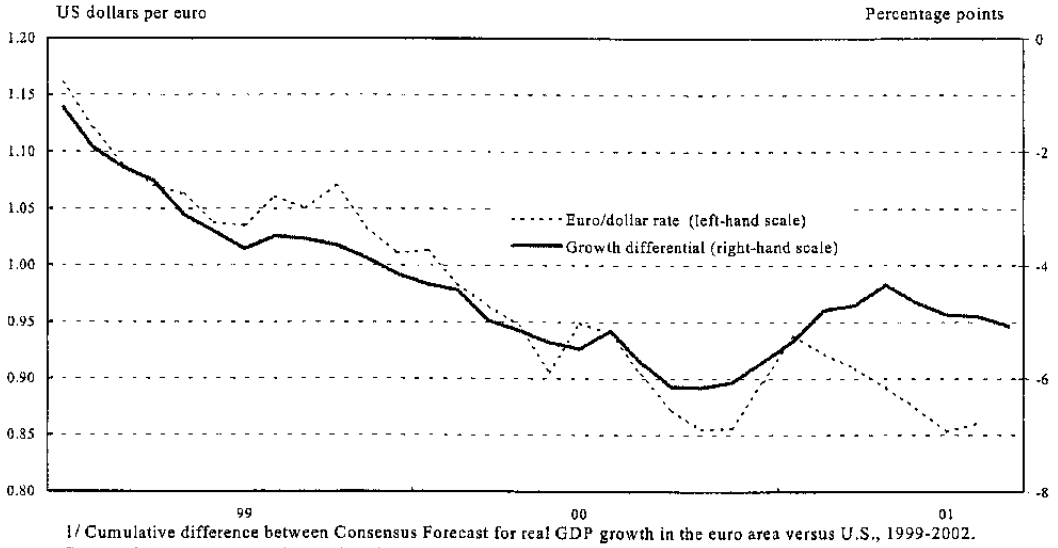
Source: INS.

Figure 2. Euro Real Effective Exchange Rate Measures



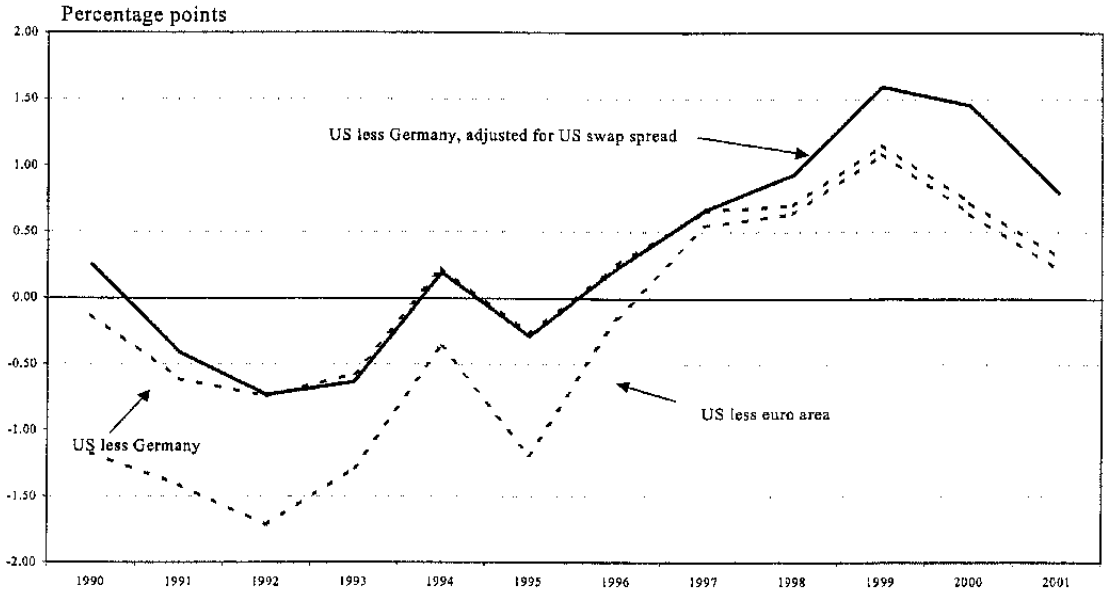
Source: INS.

Figure 3. Projected GDP Growth Rate Differential and Euro/Dollar Exchange Rate 1/



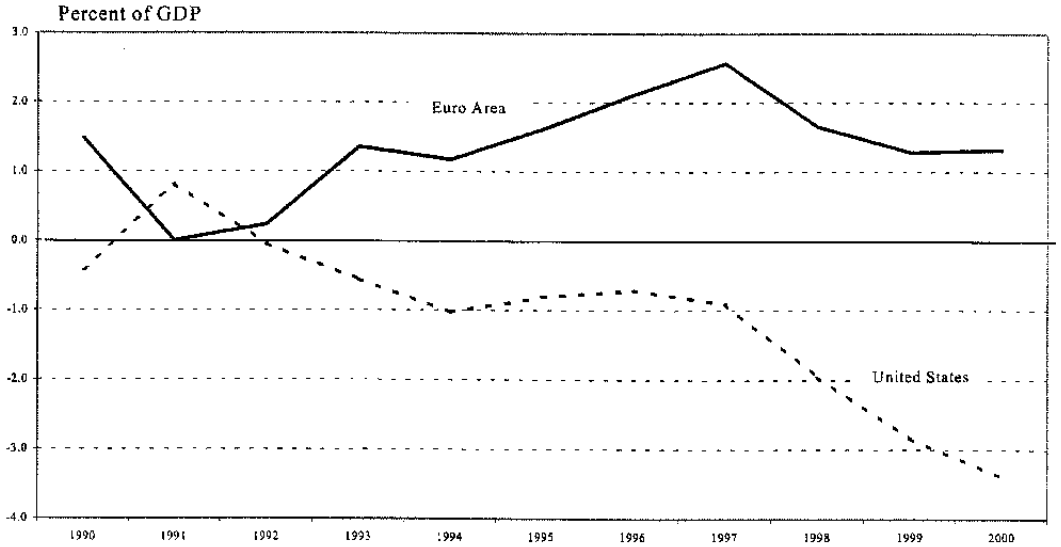
1/ Cumulative difference between Consensus Forecast for real GDP growth in the euro area versus U.S., 1999-2002.
Source: Consensus Economics, various issues, and INS.

Figure 4. Long-Term Government Bond Yield Differentials



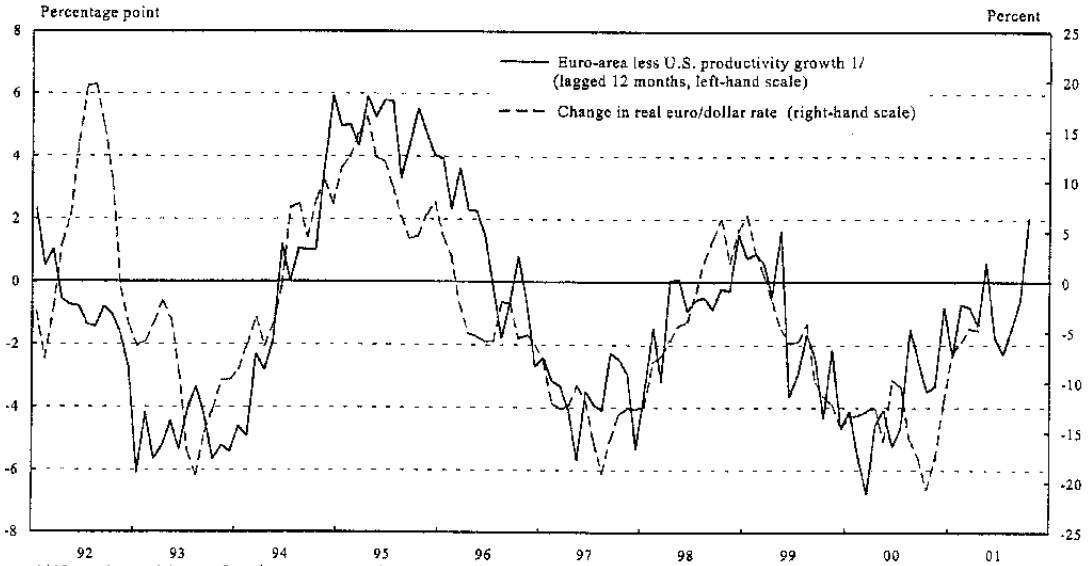
Source: WEFA and Bloomberg.

Figure 5. Current Account Balances
(Excluding oil trade)



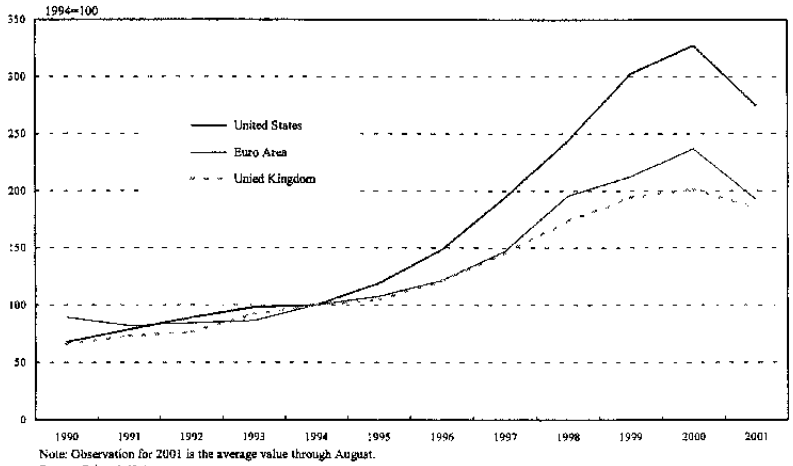
Source: WEO Database.

Figure 6. Productivity Growth and Changes in the Euro



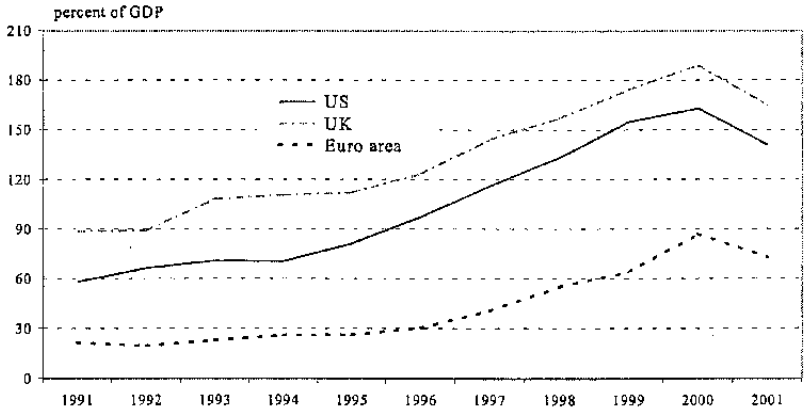
1/ 12-month growth in manufacturing output per worker.
Source: Datastream and INS.

Figure 7. Equity Price Indexes



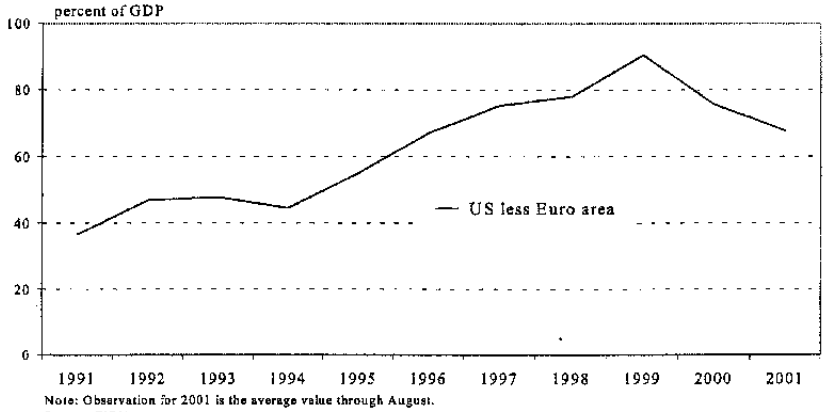
Note: Observation for 2001 is the average value through August.
Source: Primark Datastream.

Figure 8. Equity Market Capitalization Ratios



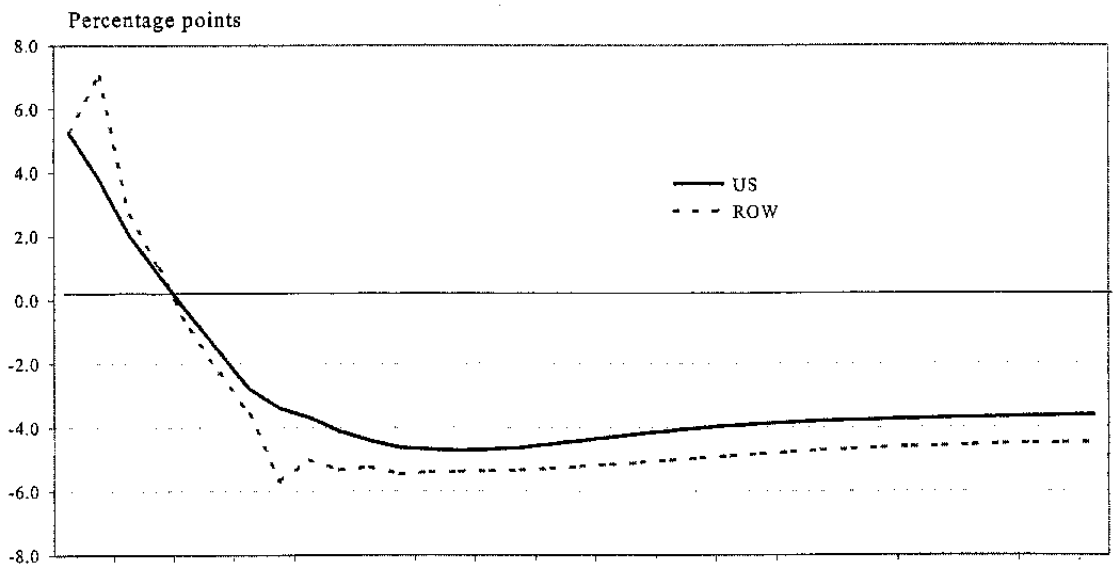
Note: Observation for 2001 is the average value through August.
Source: FIBV.

Figure 9. Differences in Equity Market Capitalization Ratios



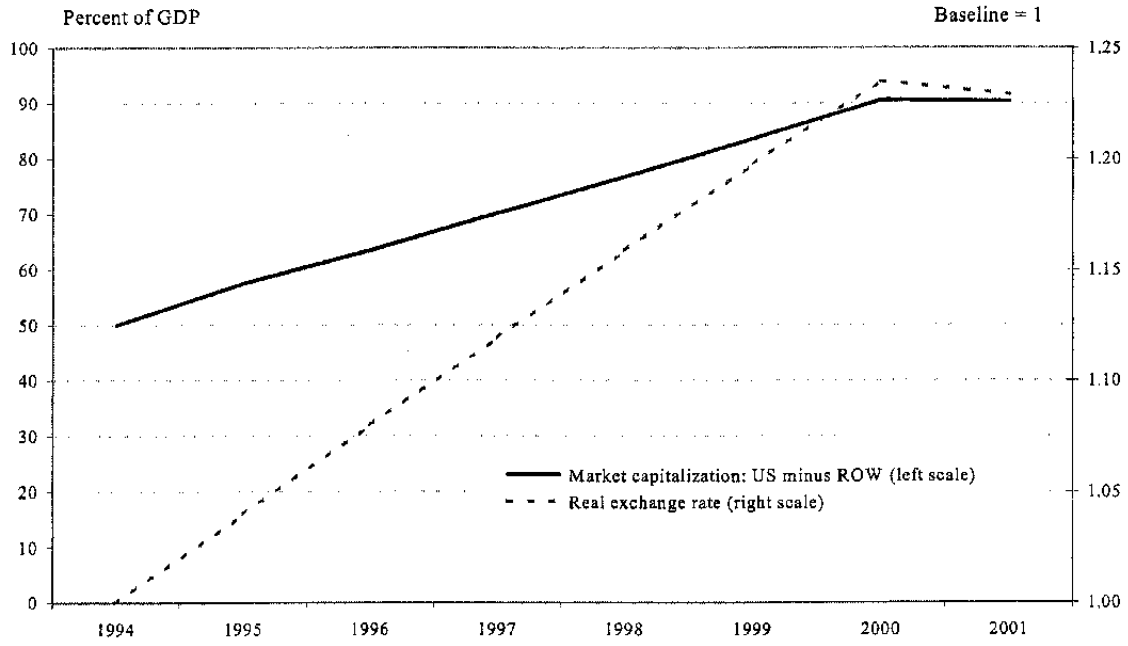
Note: Observation for 2001 is the average value through August.
Source: FIBV.

Figure 10. Simulated Equity Premia



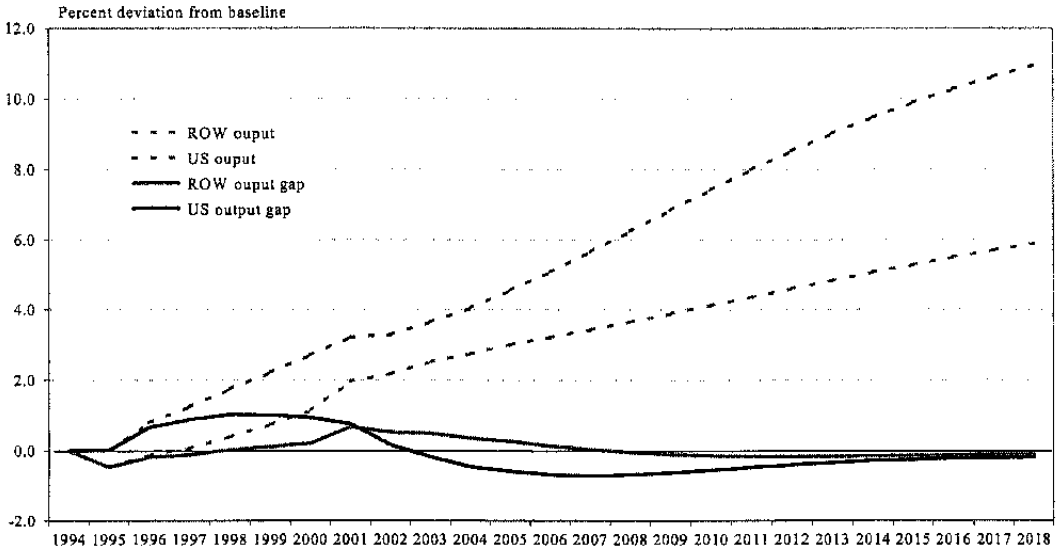
Source : Staff calculations.

Figure 11. Simulated Market Capitalization and Exchange Rate



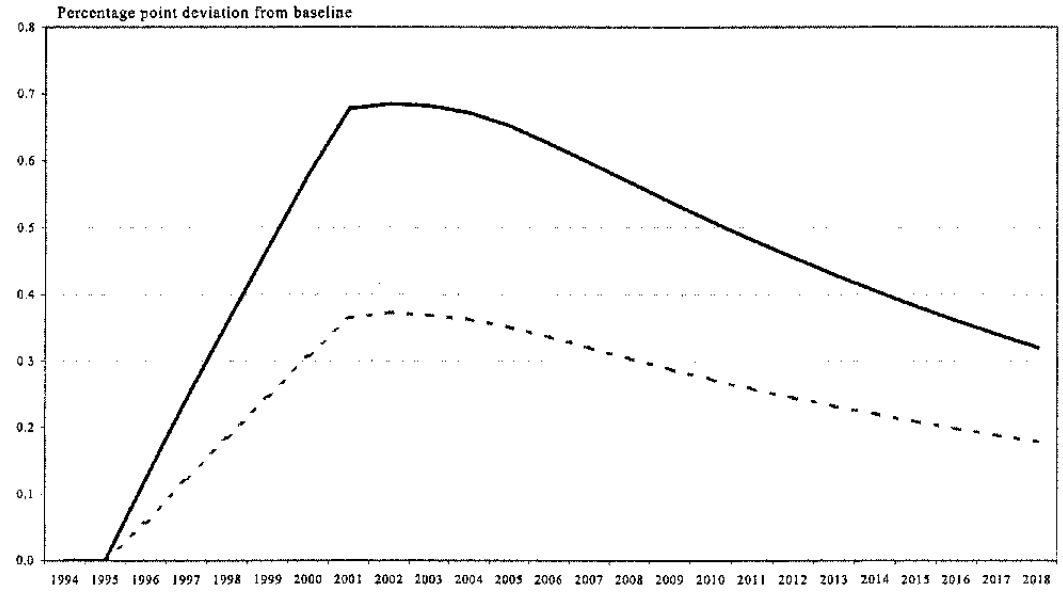
Source: Staff calculations.

Figure 12. Simulated Output and Output Gaps



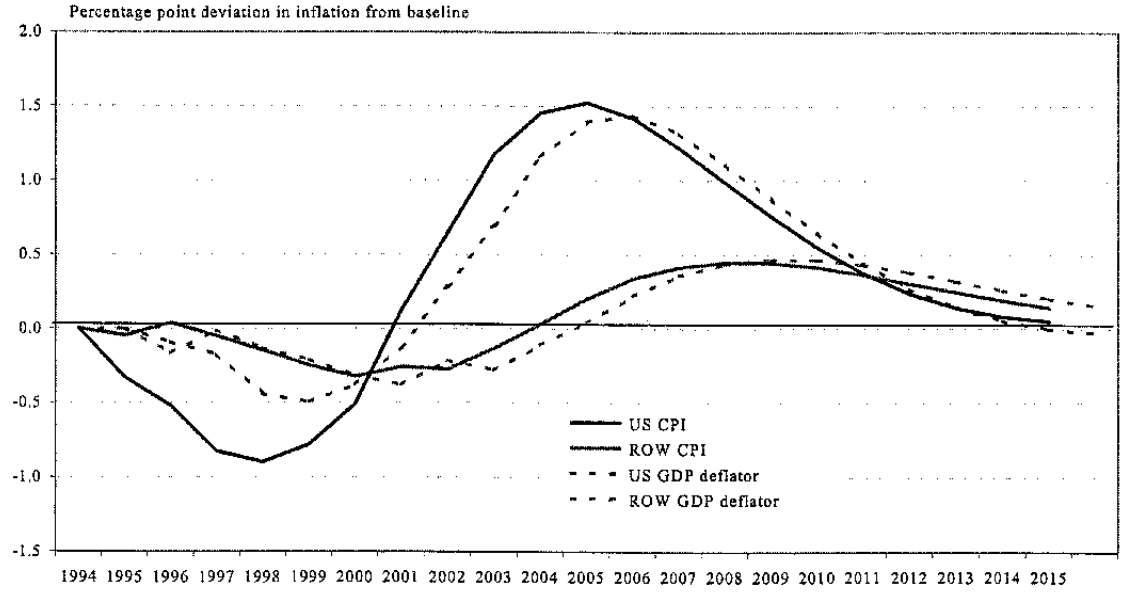
Source: Staff calculations.

Figure 13. Simulated Trend Labor Productivity Growth



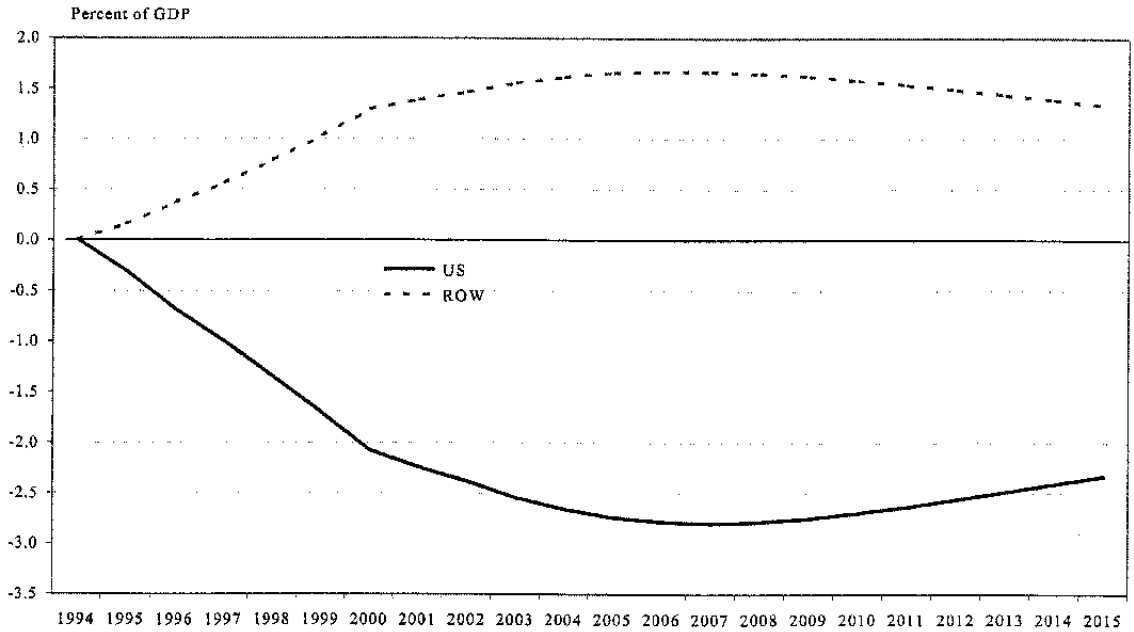
Source: Staff calculations.

Figure 14. Simulated Inflation Rates



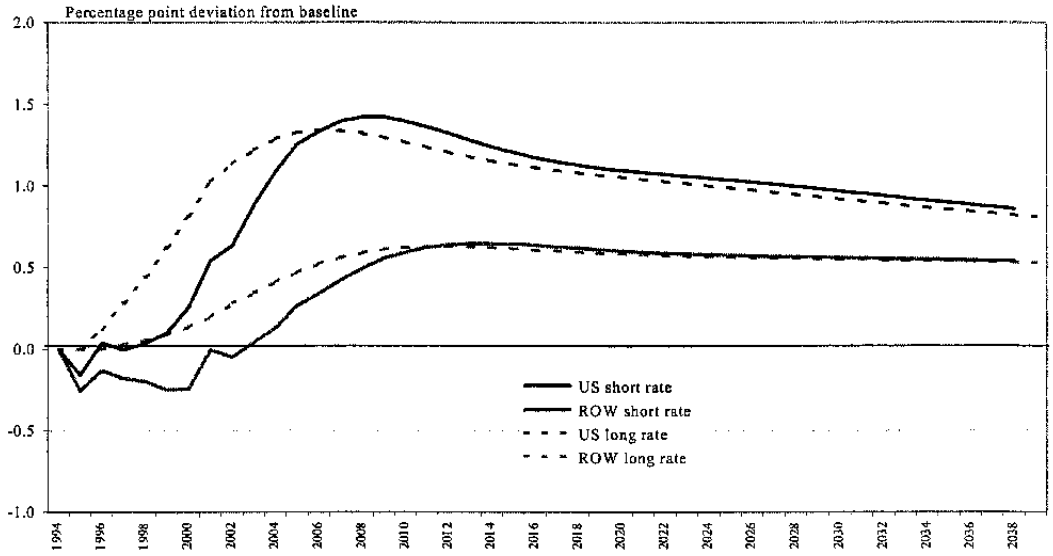
Source: Staff calculations.

Figure 15. Simulated Trade Balances



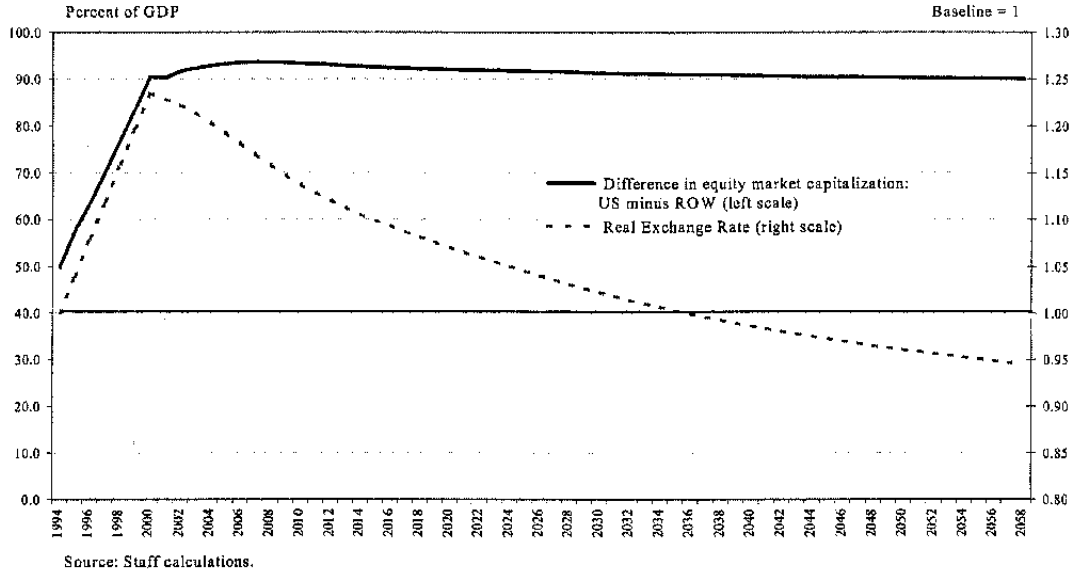
Source: Staff calculations.

Figure 16. Simulated Real Interest Rates



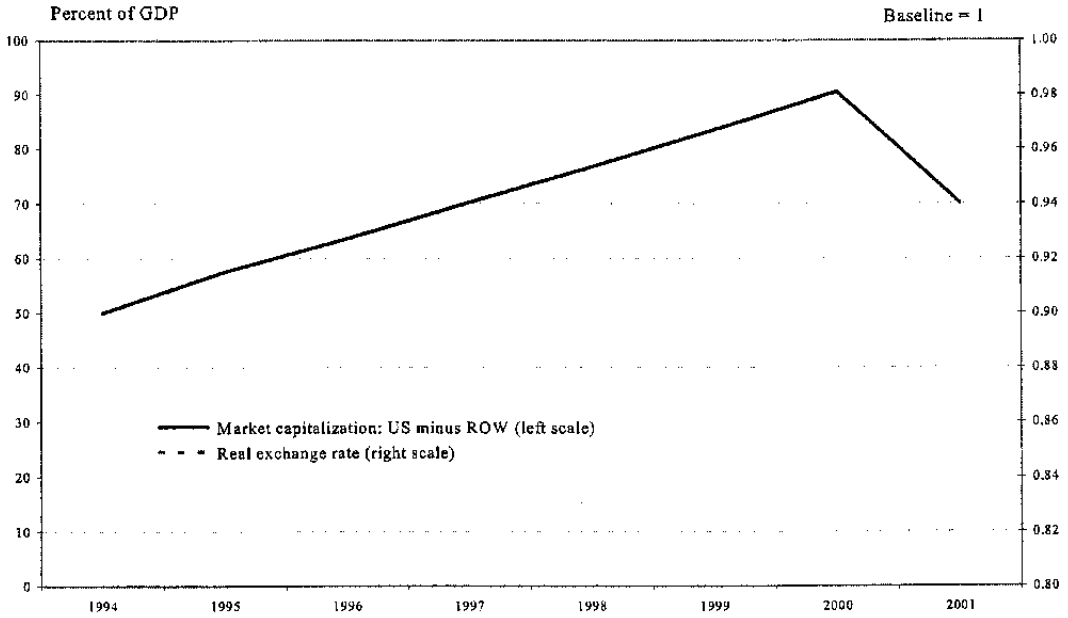
Source: Staff calculations.

Figure 17. Simulated Market Capitalization and Exchange Rate: Permanent Shock



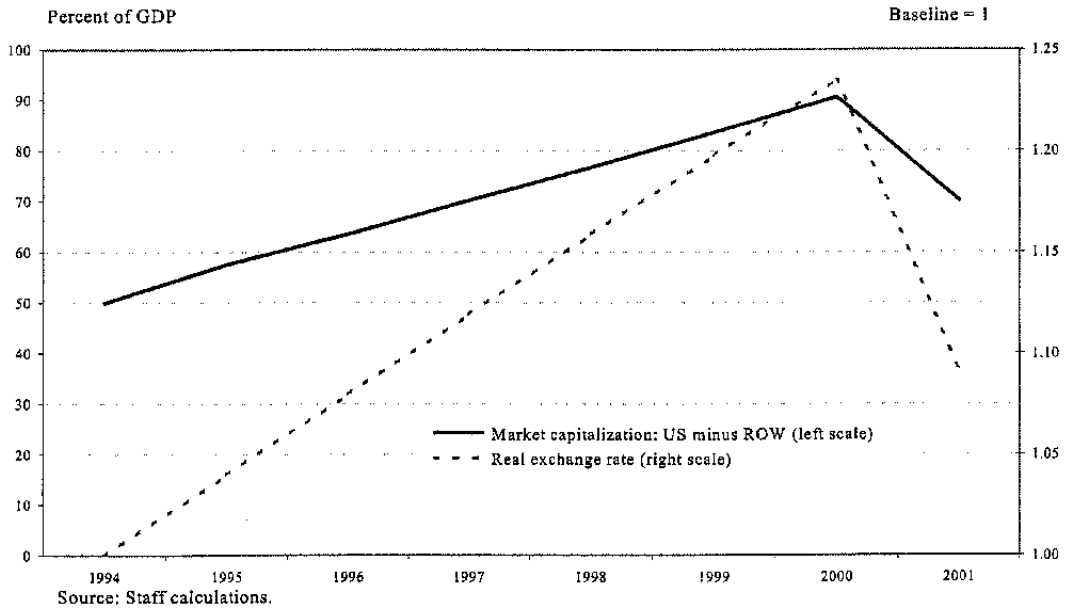
Source: Staff calculations.

Figure 18. Market Capitalization and Exchange Rate: Productivity Shock



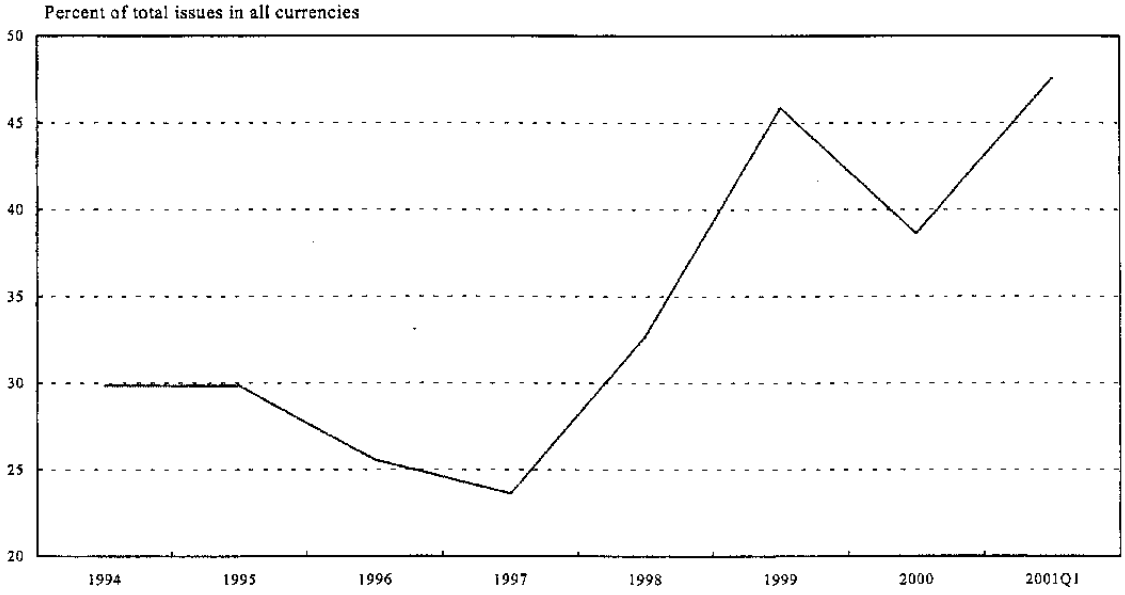
Source: Staff calculations.

Figure 19. Simulated Market Capitalization and Exchange Rate: Zero Equity Premium in 2001



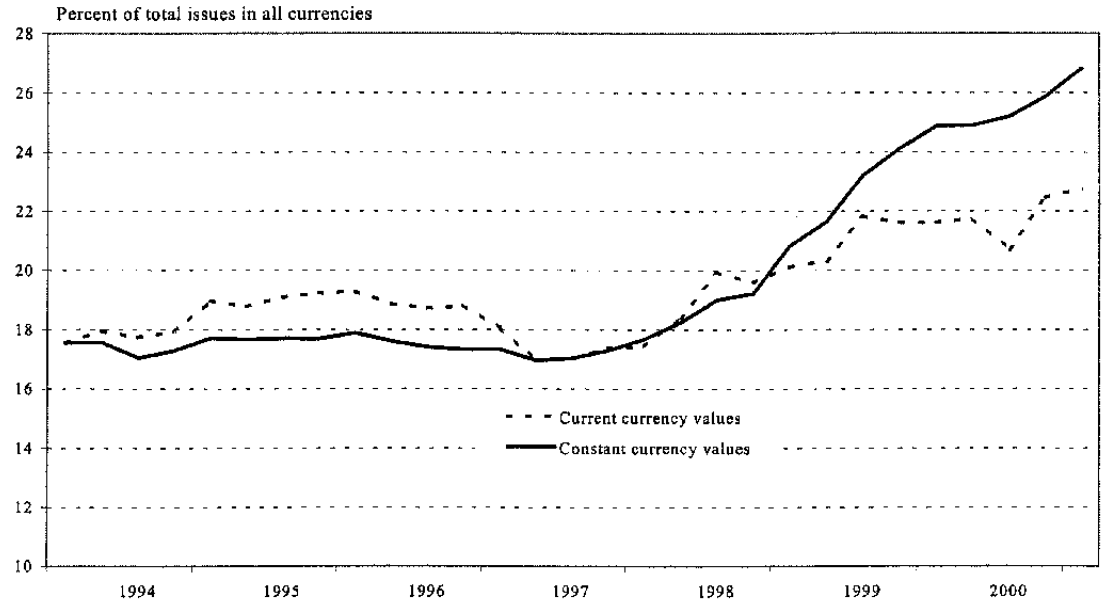
Source: Staff calculations.

Figure 20. New Issues of Euro-denominated Debt Securities



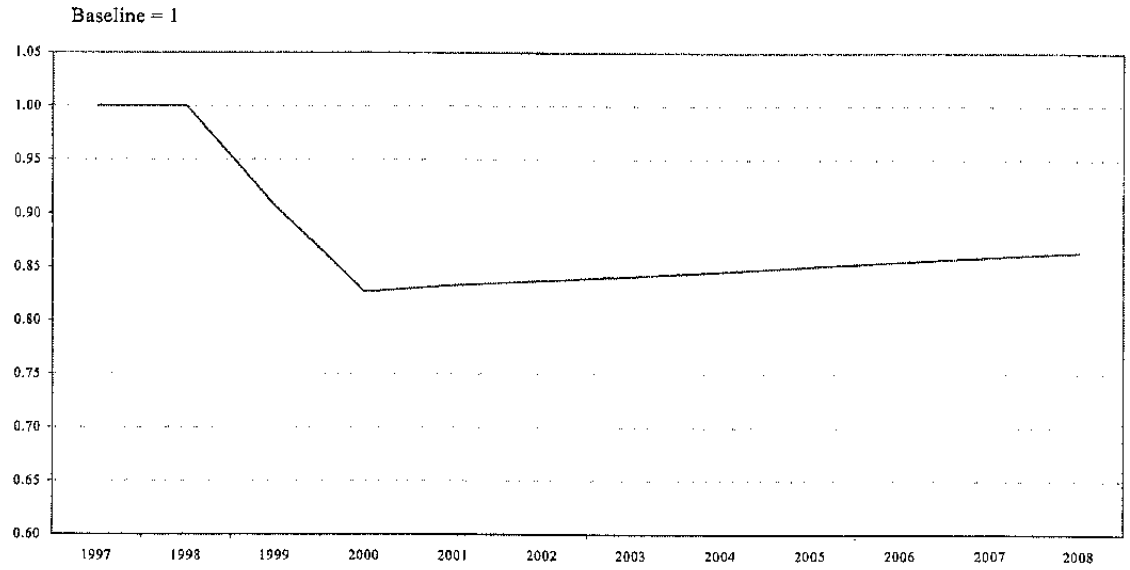
Source: BIS.

Figure 21. Euro-denominated Share of International Debt Issues



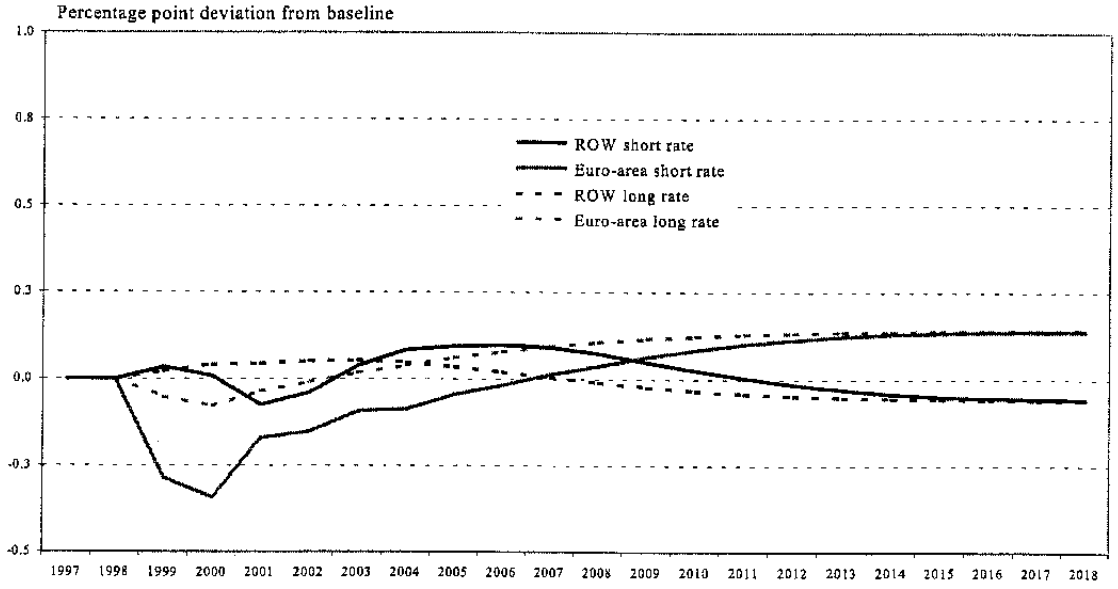
Source: Updated data from Detken and Hartmann (2000).

Figure 22. Simulated Euro Exchange Rate: Shock to Excess Yield



Source: Staff calculations.

Figure 23. Simulated Real Interest Rates: Shock to Euro Excess Yield



Source: Staff calculations.

III. Tracking the Pass-Through of External Shocks to Euro-Area Inflation[1]

A. Introduction and Summary

1. Since the launch of monetary union, the euro area economy has been confronted by the largest import price shock in two decades. Rising oil prices and a weakening exchange rate quickly showed up in mounting headline inflation, and the subsequent pass-through to other retail prices have impacted—and complicated the reading of—conventional core inflation indicators. HICP inflation excluding energy and unprocessed food broke through the ECB's 2 percent upper limit for price stability in April 2001 and has remained above it since.

2. Lagged pass-through remains an important factor shaping the area's inflation outlook. The analysis in this paper finds that:

- the regime change associated with the euro initially appeared to have slowed the degree of exchange rate pass-through to import prices and consumer prices; however, import prices have been catching up with normal pass-through patterns as euro weakness has lingered on;

- the doubling in core HICP inflation since 1999 is essentially due to the pass-through of external shocks (and recent food price hikes);

- underlying domestic inflation pressure has remained subdued;

- as pass-through effects are worked off and domestic price pressure remains benign, annual core inflation is likely to drop below 2 percent in the not-too-distant future.

B. The Stages of Pass-Through

3. The pass-through of external price shocks to consumer prices occurs in two stages: the pass-through from exchange rate or oil price changes to import prices (Stage One); and the pass-through from import prices to retail prices (Stage Two). As for the latter, it is conventional to distinguish between *direct* effects—namely, changes in the retail price of imported consumer products (including energy consumed by households)—and *indirect* effects, which arise as changes in the cost of imported intermediate goods are passed along the production chain. Indirect effects may also arise through a "competing goods effect" whereby domestic firms utilize any competitive headroom offered by higher import prices to raise their own prices.

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[1] Prepared by Mads Kieler (Mkieler@imf.org).

4. More broadly, exchange rate and oil shocks are likely to affect the level of output and demand, and they may have *second-round* effects on wages and domestic inflation pressure. The focus in this paper is on the transmission of import price shocks directly or indirectly on to consumer prices for given wages and unemployment.[2]

C. A Quick Primer on Pricing-to-Market Behavior

5. An important aspect of import price determination is the degree of "pricing-to-market"; i.e., the degree to which foreign producers align their prices to those of domestic suppliers in order to maintain market share.[3] Empirically, pricing to market appears to be widespread for differentiated goods. Firms try to maintain market shares because these matter for future sales and profits when consumers face switching costs (e.g., related to information acquisition, network externalities, and long-term supply relationships). Hence, prices will tend to be set on the basis of longer-run average costs rather than short run fluctuations. In this setting, pricing-to-market may depend on how long the exchange rate change has lasted and how long it is expected to last.

6. Although pricing to market is mainly a short- and medium-term phenomenon, theory does not rule out that it may occur even in the long run. In a standard long-run or static model of pricing-to-market, oligopolistic suppliers set destination-specific price mark-ups (over production costs) as a function of the demand elasticity in each market: the higher the local elasticity of demand, the lower the mark up. In this situation, the degree of pricing-to-market depends on the perceived shape of the demand function. Demand curves less convex than a constant elasticity schedule imply less than complete pass-through—for instance, a linear demand curve implies a pass-through coefficient of less than one half (Krugman, 1987).

7. A twist on the pricing-to-market story is that low inflation regimes may in themselves reduce pass-through coefficients (Taylor, 2000). In a world with price rigidity, the amount by which a firm matches an increase in costs (or in competitors' prices) with an increase in its own price greatly depends on expectations about future cost and price movements. An economy with an inflation rate as low as its trading partners is less likely to experience permanent nominal depreciation because it could bring the real exchange rate out of line with fundamentals. Hence, low inflation economies should have less pass-through than economies with high and persistent inflation. Pass-through of oil price shocks would similarly depend on their expected persistence.

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[2] Wage developments and the macroeconomic outlook for the euro area are considered in the staff report on the 2001 Article IV consultation (SM/01/289).

[3] Several papers formalize such ideas, including Krugman (1987), and Froot and Klemperer (1988). See Goldberg and Knetter (1997) for an overview of the literature.

8. Taylor's argument raises the possibility that the euro may engender a regime change in participating countries—particularly those that had above-average inflation and relatively less stable currencies prior to embarking on the convergence road to EMU. So does the view that the euro will lead to more local-currency pricing by foreign firms selling in the area (Devereux, Engel, and Tille (1999)).[4]

9. Pricing-to-market may occur both at the level of import prices (as foreign producers vary their margins) and retail prices (as importers and retailers do the same). Since data on import prices or unit values are readily available, the first stage is by far the easiest to analyze, and it has been the main focus of the literature on exchange rate pass-through. There is less empirical evidence on Stage Two.[5] Nonetheless, the growing list of countries that have experienced large currency depreciations with little subsequent inflation pressure in the last decade has shown that—even when pass-through in Stage One has been nearly complete—pass-through to consumer prices in Stage Two can be limited. It also appears to have been smaller than in the (high-inflation) past.

D. Stage One: The Import Price Shock

Magnitude and anatomy of the external shock

10. The rise in world market oil prices and the slide in the euro against most major currencies have driven up the area's import prices by almost 15 percent since the last quarter of 1997, when a barrel of oil cost $19 and the synthetic euro stood at $1.12 (Figure 1).[6]

11. Energy prices account for almost one half of the shock to import prices (Table 1). Within that, movements in the

Table 1. Euro Area: Import Price Shock
(1997 Q4 to 2001 Q1)

	Change (percent)	Contribution 1/ (percentage points)
Import prices (goods and services)	13.3	100
Non-energy import prices	8.4	57
Energy import prices	56.6	43
- Euro/US dollar exchange rate	17.5	14 2/
- Oil price in US dollar	42.2	30 2/
Memorandum item		
Nominal effective exchange rate	13.0	-

Sources: Eurostat, ECB, and staff calculations.
1/ Contribution to import price change using 1997-2000 import weights.
2/ Assuming that all of the change in energy import prices is attributable to changes in the oil price in USD and the EUR/USD rate.

[4] Although Obstfeld and Rogoff (1999) note that the time horizon over which trade invoicing induces price stickiness appears too brief to have a large impact on macroeconomic interactions at business cycle frequencies.

[5] Exceptions include Dwyer and Lam (1995), McCarthy (1999), and Engel (2000).

[6] Import prices have risen by 25 percent since early 1999 when oil prices were exceptionally low. A proxy for extra-area import prices for goods and services has been derived from national accounts statistics by assuming that intra-area trade prices evolve in line with the area's domestic producer prices of finished goods. This proxy is broadly consistent Eurostat's unit value series (which covers goods only).

oil price in dollar account for two thirds of the total movement in the oil price measured in euro. Consequently, the external shock may be said to be roughly two-thirds exchange rate-related, and one third oil price-related.

Pass-through to date

12. An important question at the current juncture is whether import prices have adjusted fully to the underlying shocks. Changes in world market prices for oil and the US dollar have continued to be reflected in the prices of the area's energy imports almost immediately. In the absence of new shocks, no further pressure is likely from this source.

Table 2. Euro Area. Exchange Rate Pass-Through for Non-Energy Import Prices
(from 1997 Q4 to 2001 Q1; in percent)

(a) Non-energy import prices	8.4
(b) Foreign producer prices 1/	1.0
(c) Exchange rate effect 2/	7.4
(d) Nominal Effective Exchange Rate	13.0
Rate of Pass-through 3/	57.0

Sources: Eurostat; OECD; IMF; staff calculations.
1/ Import-weighted average of trading partners' prices.
2/ Defined as (a) - (b).
3/ Defined as (c) / (d).

13. As for non-energy prices, a back-of-the-envelope calculation reveals that more than half of the exchange rate change since end-1997 has been passed through to import prices (Table 2).

14. A different perspective on the same issue can be gained by investigating the degree of pricing-to-market. Under this hypothesis, the import price may be thought of as a weighted average of the domestic prices of euro-area suppliers and foreign costs:

$$pm = \alpha\, ppid + (1-\alpha)\, ppif$$

where *pm* is import prices, *ppid* is domestic producer prices, *ppif* is foreign producer prices measured in euro, all excluding energy and measured in logs, and α is the pricing-to-market coefficient.

15. This framework can be used to provide a snap-shot of pricing-to-market to date: the 8.4 percent rise in non-energy import prices since 1997 Q4 (cf. Table 3) is a linear combination of the increase in domestic prices (3 percent) and rising foreign costs in euro (14 percent) with a weight of roughly one half given to each factor.

Table 3. Euro Area. Pricing-to-Market
(from 1997 Q4 to 2001 Q1; in percent)

(a) Non-energy import prices	8.4
(b) Domestic producer prices 1/	3.0
(c) Foreign producer prices in euro	14.1
Pricing-to-Market Coefficient 1/	51.5

Sources: Eurostat; OECD; IMF; staff calculations.
1/ Consumer and capital goods.
2/ Weight on domestic prices (b) relative to foreign prices (c) in determining import prices (a).

16. If domestic producer prices rise in response to the demand and cost pressures of an exchange rate depreciation, pass-through can be high even when there is pricing-to-market. If purchasing power parity holds in the long run, exchange rate pass-through will ultimately be complete.

Has the euro spurred a regime change?

17. To assess whether the developments outlined above are in line with historical experience, import price equations were estimated for the five largest euro-area countries on national price data spanning 1975-98, with the period 1999-2000 reserved for testing possible structural breaks after the introduction of the euro. The estimated models essentially relate non-energy import prices to domestic producer prices (the pricing-to-market element) and foreign costs (the pass-through element).[7]

18. The results indicate that the historical degree of pricing to market was highest in Germany, followed by a middle group of France and the Netherlands, while it was smallest in Italy and Spain (Table 4). These results are consistent with the existing evidence in the pricing-to-market literature in suggesting that:

- pricing-to-market is a common phenomenon across countries;
- pricing-to-market is most pronounced in large countries with low inflation regimes, whereas exchange rate pass-through has been stronger for countries with historically high inflation.

Table 4. Import Prices. Long-Run Coefficients

	Pricing to Market	*Foreign Costs*
Germany	0.53	0.47
France	0.48	0.52
Italy	0.22	0.78
Spain	0.36	0.64
Netherlands	0.46	0.54

Source: staff estimates.

19. However, despite signs of slower pass-through to import prices in the post-1999 sample in some cases, the estimations failed to uncover clear signs of regime change where one would most expect it, namely in those countries that formerly had comparatively high inflation (Italy and Spain).

20. A cross-country examination reveals that non-energy import prices have risen roughly in lock-step in Germany and the Netherlands since the launch of EMU, somewhat more in Italy and Spain, and clearly less in France (Figure 2). These differences are not related in any straightforward manner to the trading patterns of the individual countries—Germany and the Netherlands have seen the largest effective depreciation on account of larger extra-area trade.

21. In 1999, euro-area import prices initially increased less than might have been expected relative to the extent of currency depreciation (Figure 3)—possibly because economic operators did not expect euro weakness to last. But as the euro failed to recover decisively against other currencies, import prices have caught up. Pass-through is no longer out of line with historical experience, and (with the possible exception of France), the underlying shocks appear to have been incorporated in import prices.

[7] Details on the estimation procedure are available upon request.

E. Stage Two: The Impact on Consumer Prices

22. In what follows, the impact on retail prices is gleaned from a combination of methods, including input-output calculations, econometric specifications, and analysis of alternative measures of domestic inflationary pressures.

Import and energy content in consumers' expenditure

23. The direct share of imported consumer items in euro-area private consumption (excluding imputed rents) is modest (around 7 percent).[8] Yet, the total import dependency is larger when intermediate inputs used in the domestic production of consumer items are considered. Based on total import content (around 15 percent), a shock to import prices of the magnitude experienced since 1997 would translate into an increase in the HICP price level by 2½ to 3 percentage points if there were full pass-through to retail prices.[9]

24. Almost half of the import price shock is attributable to higher oil prices in euro. Most of the direct effect of this shock has already come through to consumer energy prices: exacerbated by indirect tax increases, energy price hikes have added 1½ percent to the HICP level since the fourth quarter of 1997.[10]

25. HICP inflation excluding energy and unprocessed food (HICPX) has doubled over the last couple of years and it breached 2 percent in April 2001. Prices accelerated for all three components of HICPX, namely processed food (including alcohol and tobacco), industrial goods, and services (Figure 4). While the increase in processed food prices was distorted by supply shocks in the food sector, the pass-through of external shocks is clearly identifiable in the prices of industrial goods and services. Inflation for industrial goods has increased from ½ percent one year ago to 1½ percent, while services prices have accelerated from below 2 percent to 2½ percent.

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[8] The retail prices of imported consumer products generally contain a significant component of domestic value-added in the distribution and retail sectors as well as taxes. The input-output share refers to the pure import content.

[9] Including the associated increase in ad valorem indirect taxes.

[10] In addition, shocks to fresh food prices—related to unusual weather conditions and animal diseases that reduced food supply and engendered a switch to niche products—helped to drive up headline inflation to a peak of 3.4 percent (year-on-year) in May 2001.

26. In general, the services sector is more shielded from import price shocks than the industrial sector. Examination of the area's production structure with the help of provisional input-output data indicates that the 6 percent direct and indirect import content in services compares to some 22-23 percent for food and non-energy industrial goods (Table 5). At first blush, one might therefore be tempted to conclude that the rise in services inflation during 2000 and 2001 was unrelated to the external shocks. Yet, the energy used in the production of services—e.g., for heating, transport, and distribution—is not much smaller than that of the industrial sector (Table 6). This gives reason to believe that energy price shocks have had a significant impact on price movements in services as well (more below on the dynamics of the transmission of energy price shocks to final sales prices).

Table 5. EU5. Import Content in Consumption
(based on input-output analysis; in percent 1/)

	Food & drink	Industrial goods	Services 2/	Household consumption 2/
Total	22	23	6	15
Direct	9	12	1	7
Indirect	12	10	6	8

Source: Eurostat, and staff calculations.
EU5 = Germany, France, Italy, Spain, and the Netherlands.
1/ Harmonized input-ouput data projected to 2000; provisional.
2/ Excluding Imputed Rents.

Table 6. EU5. Energy Content in Consumption
(based on Input-Output analysis; in percent 1/)

	Food & drink	Industrial goods	Services 2/	Household consumption 2/
Total	4½	3½	3	9½
Direct	-	-	-	6
Indirect	4½	3½	3	3½

Source: Eurostat, and staff calculations.
EU5 = Germany, France, Italy, Spain, and the Netherlands.
1/ Harmonized input-ouput data projected to 2000; provisional.
2/ Excluding Imputed Rents.

Dynamics and tests for regime change

27. In order to gain insight into the speed with which exchange rate changes have affected consumer prices in the past, consumer prices have been modeled as a mark up over costs:[11]

$$p = log(\mu) + \alpha\, ulc + \delta\, pxf + \gamma\ poil.$$

where p denotes the CPI level; μ the mark-up factor; *ulc* nominal unit labor costs in the total economy; *pxf* foreign non-oil export prices in synthetic euro; and *poil* the oil price in euro (lower-case letters denote logs of the variables). Both the mark-up and costs may vary over the cycle. It turns out that the mark-up has been steadily increasing over the estimation period (mirroring the trend decline in the labor share in value-added). A time trend is added to capture this feature which reflects, among other things, a rising capital-output ratio and higher indirect taxes.

[11] The model and estimation strategy largely follow de Brouwer and Ericsson (1998).

28. Using an estimation procedure suggested by Pesaran and Smith (1998), the estimated long-run equation over the sample period 1976-1998 is:

$$p = \underset{(0.06)}{0.74\ ulc} + \underset{(0.05)}{0.14\ pxf(in\ euro)} + \underset{(0.01)}{0.016\ poil} + \underset{(0.001)}{0.002\ trend.}$$

The long-run coefficient on *pxf* is virtually identical to the import share indicated by input-output analysis. The long-run coefficient on *poil* ties in well with a widely used rule of thumb for the direct impact of oil prices on HICP (namely, that a 10 percent shock to oil prices raises HICP by 0.1 percent), when indirect effects are borne in mind.

29. Starting from a general dynamic model and simplifying to a statistically acceptable error correction model yields the following equation for the one-quarter change in prices:

$$\Delta p = const + \underset{(0.08)}{0.17\Delta p_{-1}} + \underset{(0.03)}{0.06\Delta pxf_{-1}} + \underset{(0.04)}{0.10\Delta ulc} + \underset{(0.04)}{0.12\Delta ulc_{-2}} + \Delta poil\ terms - \underset{(0.02)}{0.14ECM_{-1}}$$

Sample: 1976:1 – 1998:4, $R^2 = 0.95$ $\sigma = 0.2\%$ DW = 1.9

The impulse responses to exchange rate and oil price shocks are shown in Figure 5. Historically, 80 percent of an exchange rate shock fed through to consumer prices within two years. For oil, the direct effect came through to CPI within one quarter, while the full impact tended to have been reached four to five quarters after the shock.

30. One would expect pass-through to be slower in a low inflation regime where exchange rate changes have less persistence. The out-of-sample performance of the equation does indeed suggest that pass-through has been (modestly) reduced after the introduction of the euro. In the early part of the post-sample EMU period, actual inflation was below the model prediction—although all observations remain within their 95 percent confidence bands. Yet, the rise in consumer prices in late 2000 and early 2001 (exacerbated by food price shocks) brought actual CPI closer to projected CPI by the first quarter of 2001.

Domestic inflation pressure remains subdued

31. The impulse responses above may be used to extract the transmission of energy price shocks from core HICP.[12] The resulting indicator—which removes both the direct and indirect effects of energy price shocks, as well as food price shocks—is denoted by HICPXX and shown in Figure 6. After hovering in the 1-1¼ percent range in 1999-2000, HICPXX inflation has risen to 1½ percent during 2001, suggesting that producers and retailers may have begun to pass on earlier exchange rate increases on to consumers.

[12] It is assumed that any regime change on account of the euro concerns the pass-through of exchange rate changes rather than energy prices.

32. More conventional indicators of domestically generated inflation pressure such as the GDP-deflator and normalized unit labor costs have remained similarly well behaved, rising at an annual rate of 1-1¾ percent (Figure 7). The GDP-deflator is a proximate measure of domestically generated inflation: in addition to consumer items it includes the prices of domestically produced investment goods, exports, and government consumption, but excludes the prices of imports.

33. If domestic producers were to react to an import price shock by immediately passing on higher costs to final sales prices, the GDP-deflator would be unaffected, all else equal. If such pass-through is gradual, however, higher import prices will temporarily lower the GDP-deflator, reflecting compressed profit margins. The slowing of the GDP deflator to an annual rate of 1 percent (year on year) in the second half of 1999 likely reflects this phenomenon. The subsequent acceleration to 1½ percent in the second half of 2000 and 1.9 percent in the first quarter of 2001 (distorted by food price shocks) is consistent with the view that companies have subsequently been passing on these costs to their sales prices.

34. The cumulative pass-through to non-energy consumer prices may be gleaned by comparing the actual evolution of HICPX with a counterfactual scenario.[13] In this metric, the cumulated impact of import price shocks on HICPX prices by August 2001 is ¾ to 1 percentage point, implying that slightly more than one half of the potential long-term effect on non-energy prices has come through.

F. Near-Term Prospects

35. Given that the price shock has not fully fed through to consumer prices, HICPX inflation is likely to remain above domestically generated inflation at least for the remainder of this year (predicated on the current constellation of exchange rates and oil prices). This does not exclude a deceleration in HICPX since the existing gap between HICPX and homegrown inflation allows for continued gradual adjustment of the price level to the import shock.

36. Producer prices of consumer goods are an important leading indicator for the rate of consumer price inflation for industrial goods (Figure 8). The peak in producer price inflation (for consumer goods) in April of this year has been followed by peak in HICP inflation for industrial goods. In a situation where demand prospects have worsened significantly, oil prices and the euro have stabilized or improved, and the lagged impact of food price shocks is gradually subsiding, producer price inflation is likely to decline significantly in the time ahead. This decline is expected to show up in easing price pressure for industrial goods, and HICPX is likely to drop below 2 percent in the not-too-distant future—possibly by the turn of the year 2001/2002.

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[13] In the "no shocks" scenario, core inflation is postulated to average 1.3 percent since March 1998, consistent with indicators of domestically generated inflation pressure.

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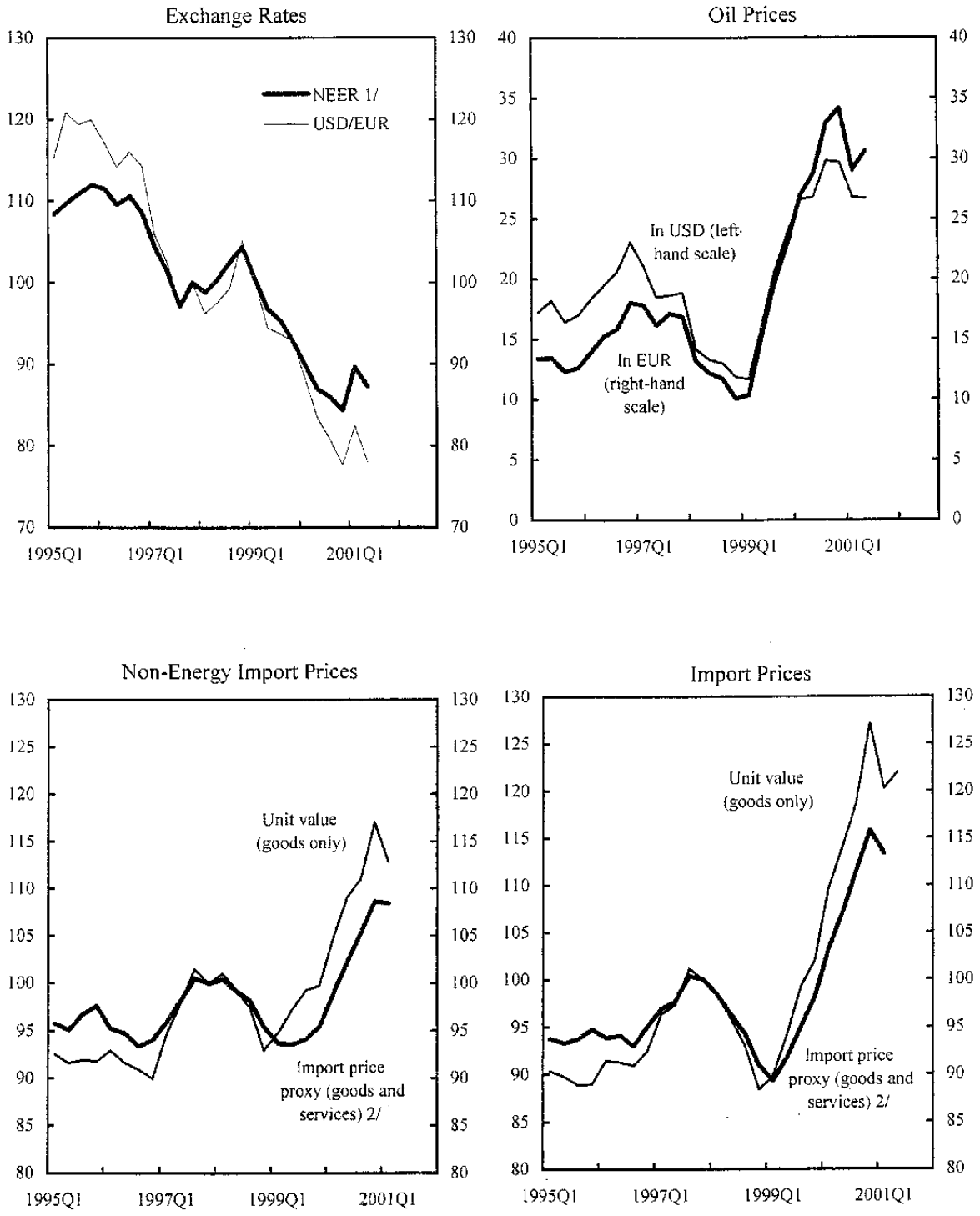
Figure 1. Euro Area. External Price Shocks, 1995-2001
(Indices: 1997 Q4=100)

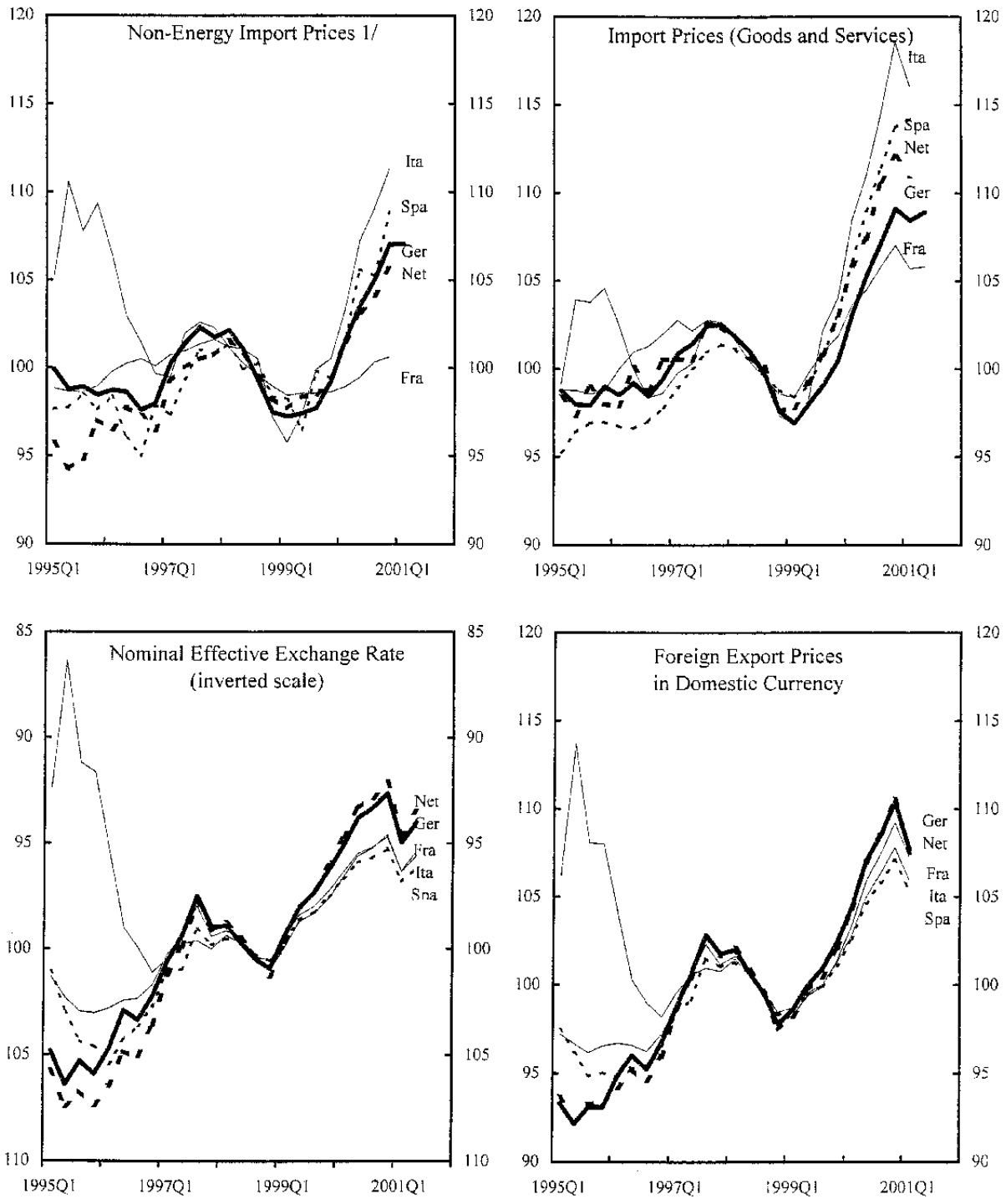


Sources: Eurostat, and ECB.

1/ Import-weighted nominal effective exchange rate (with weights based on manufactures imports, 1995-99).

2/ Staff estimate

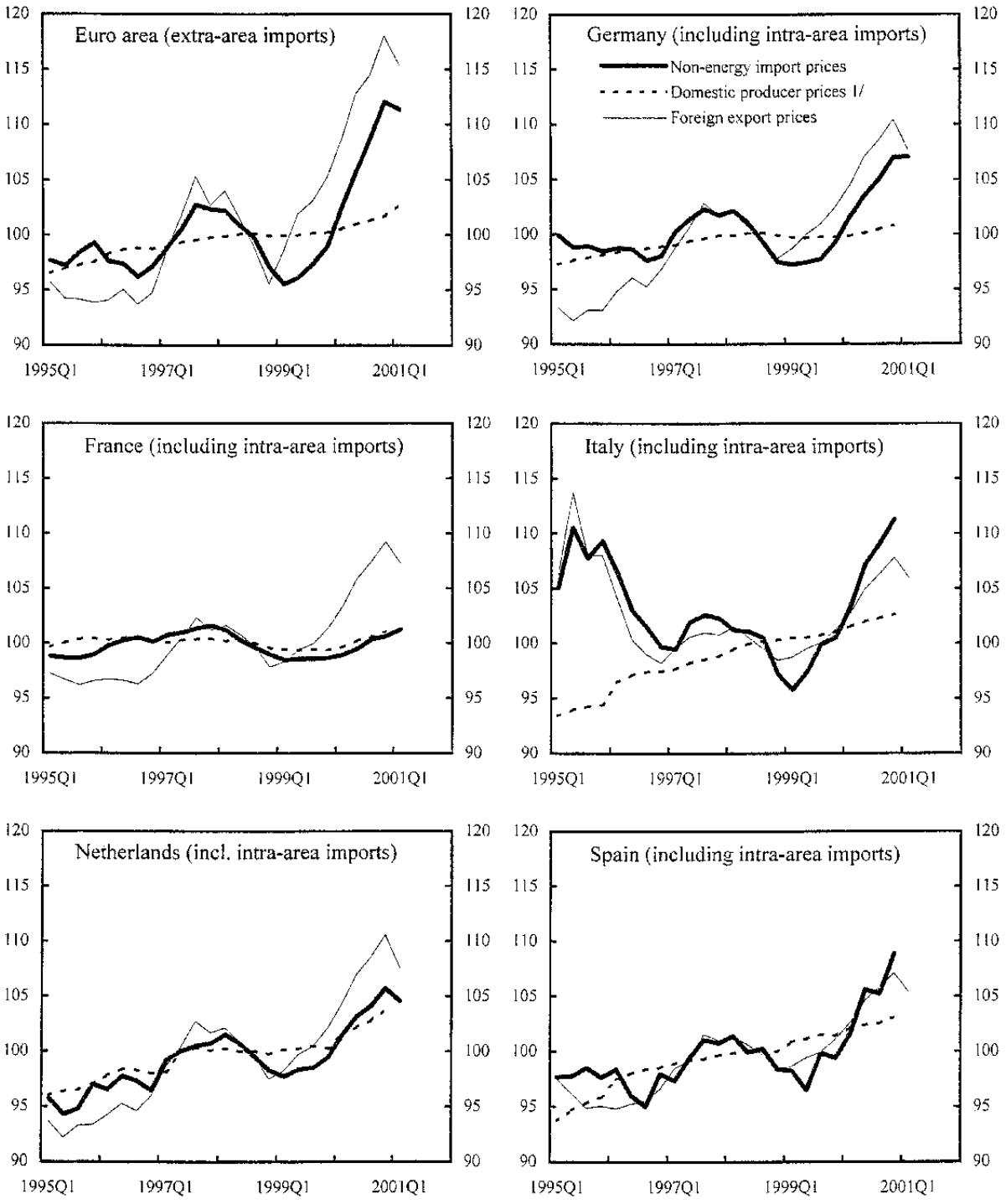
Figure 2. Euro Area: Cross-Country Perspective, 1995-2001
(Indices: 1998=100)



Sources: National sources; Eurostat; OECD; International Financial Statistics, IMF; and staff calculations.

1/ Price indices for Germany and France; unit values for Italy and Spain; spliced series for the Netherlands.

Figure 3. Euro Area: Pricing-to-Market for Non-Energy Imports, 1995-2001
(Indices: 1998 = 100)



Sources: national sources; Eurostat; OECD; IFS, IMF; and staff calculations.

1/ Producer prices for capital and consumer goods.

Figure 4. Euro Area: Components of HICPX Inflation

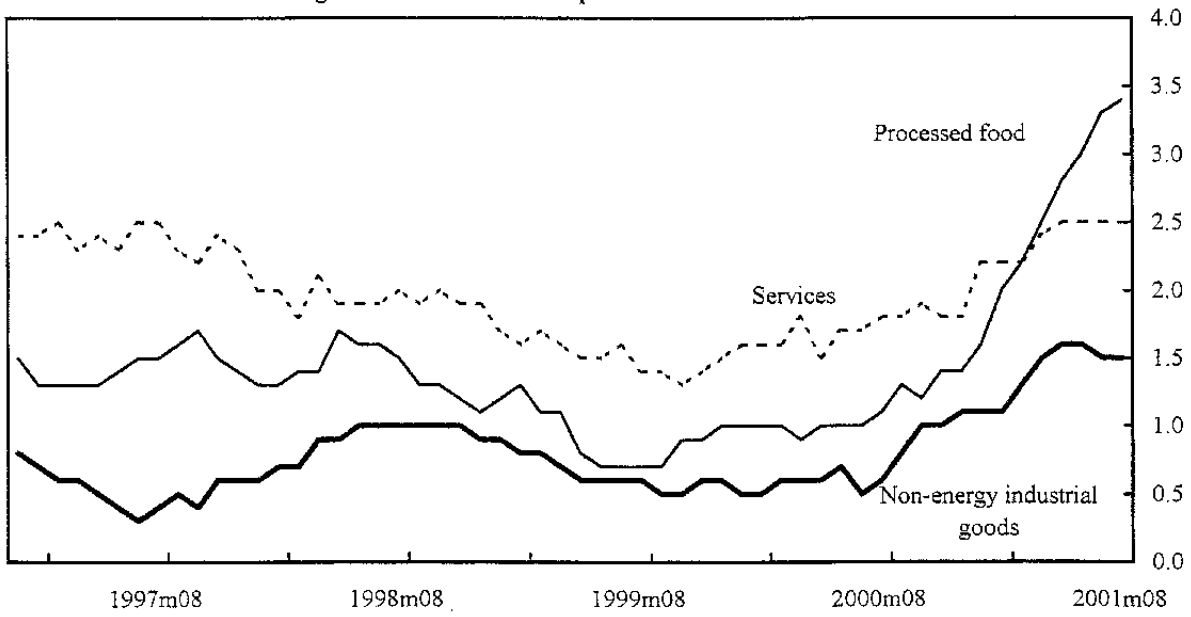
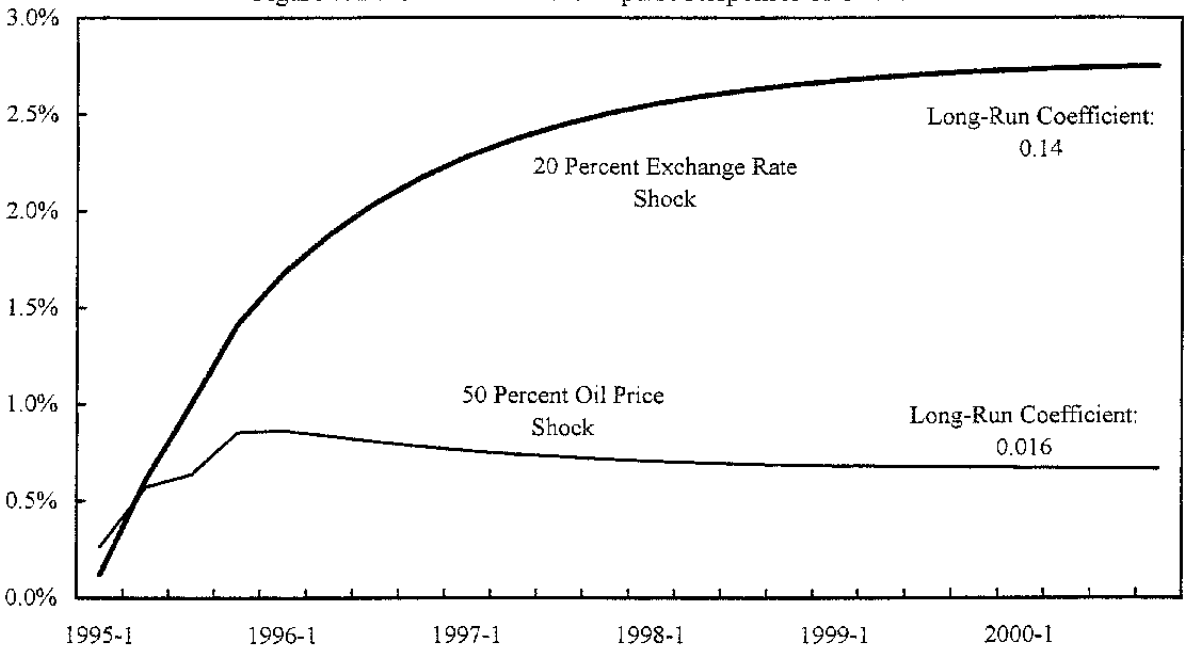


Figure 5. Euro Area: Pre-Euro Impulse Responses of CPI to External Shocks



Sources: Eurostat; and staff calculations.

Figure 6. Inflation Net of Supply-side Effects

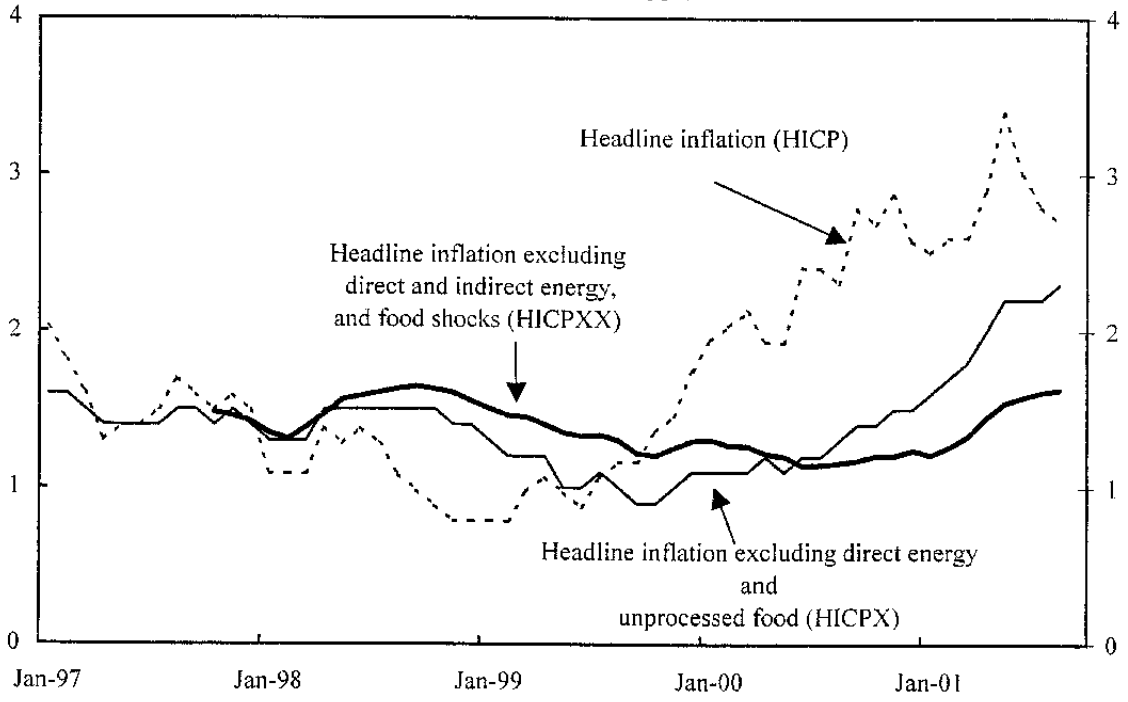
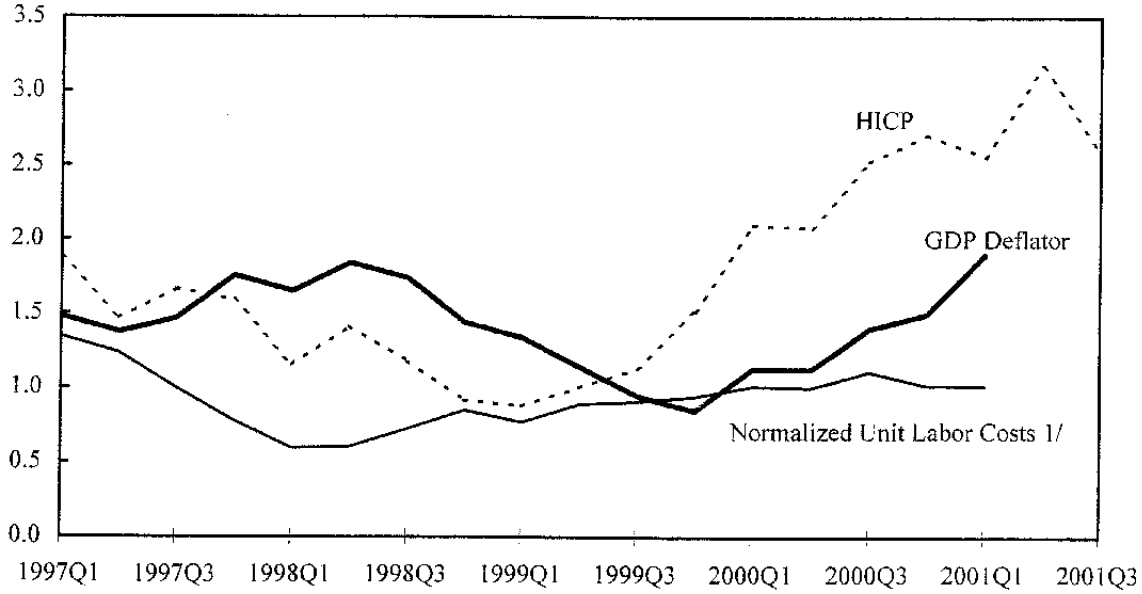


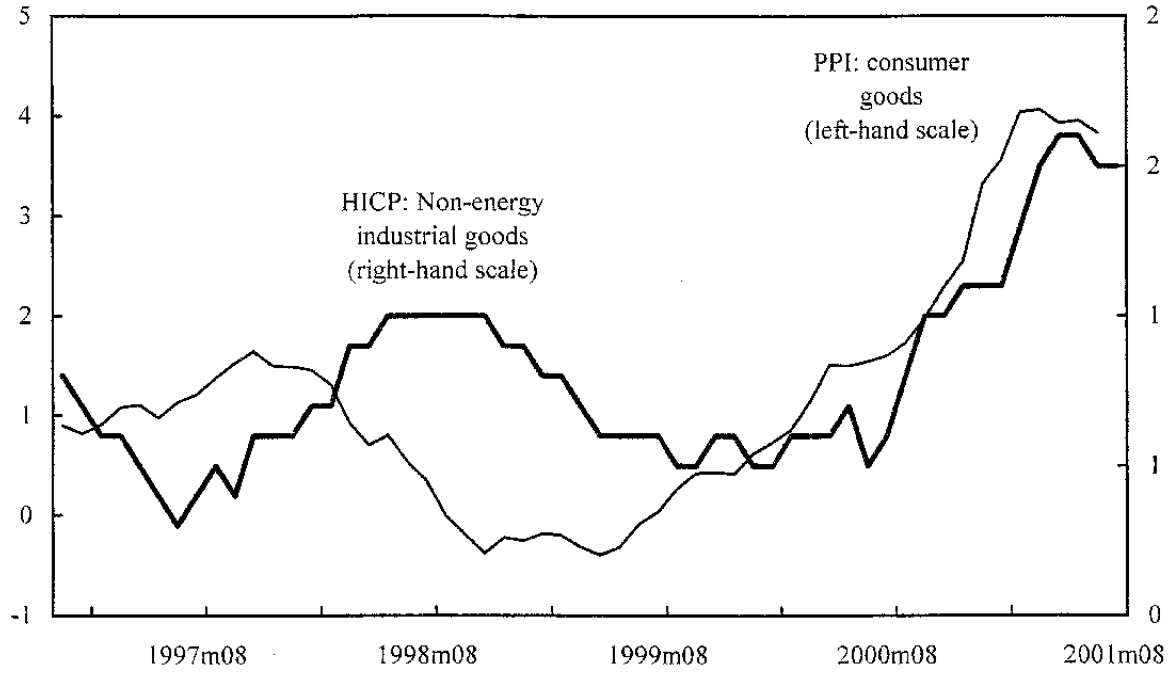
Figure 7. HICP and Domestic Inflation Pressures



Sources: Eurostat, ECB, national sources, and staff calculations.

1/ Using five-year moving average of productivity and three-quarter moving average of compensation per head.

Figure 8. Non-Energy Consumer Goods: PPI and CPI



Source: Eurostat.

IV. The ECB's Monetary Stance: First-Pillar Considerations[1]

A. Introduction and Summary

1. In October 1998 the European Central Bank (ECB) announced the Eurosystem's "stability-oriented monetary policy strategy," which would guide its monetary policy decisions in Stage 3 of European Monetary Union (EMU). Instead of announcing a target for money growth or inflation, as had been widely anticipated, the ECB chose instead to follow a strategy consisting of three main elements: a quantitative definition of the primary objective of monetary policy, namely price stability, and two pillars that would guide policy so as to achieve this objective.[2]

2. Under the first pillar a reference value for the growth of M3 is announced and revised on a yearly basis. This reference value is an important element of the monetary framework of the ECB since it allows the ECB to summarize the conditions prevailing in the money market: persistent deviations of nominal M3 growth from the reference value signal upside risks to medium-term price stability (Figure 1, top panel). Indeed, since January 1999, eight of the nine changes in the ECB's main refinancing rate appear to have been in line with the assessment that first-pillar information warrants a change in the monetary stance (Table 1).

3. Recently a number of studies have suggested that money has good leading indicator properties for inflation over the medium-term, including for the euro area, and can therefore play a useful role in the formulation of monetary policy (see Gerlach and Svensson, 2000; Trecroci and Vega, 2000, for example, and references therein). Making a judgment regarding the risks to price stability—stemming from monetary overhang—requires an estimation of an equilibrium, or trend, money growth for the euro area. The ECB's reference value is one way of estimating the trend money growth of the euro area, using the quantity theory identity. However, a direct comparison of money growth with the reference monetary growth rate, albeit easy to understand and communicate, can be misleading. Instead, several indicators have been devised to sum up money market conditions—including the nominal and real money gaps and excess money demand—and a strategy has been launched by the ECB to publicize these to the wider public.

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[1] Prepared by Zenon Kontolemis (ZKontolemis@imf.org). A longer version of this chapter containing technical details is available upon request from the author.

[2] ECB(1999), p.46. For a useful justification of the ECB's framework see Issing, Gaspar, Angeloni and Tristani (2001), and Angeloni, Gaspar, and Tristani (1999), for example.

4. This paper derives and compares a number of different measures of trend money growth which are used to define indicators of "money gap" or "monetary overhang"; these are used to summarize information from the first pillar. In doing so, it also provides an in-depth analysis of monetary conditions in the euro area through the estimation of a money demand model. This analysis also throws some light on the source and magnitude of the observed money velocity trend.

5. All these different indicators are used to provide an assessment of the risks to price stability stemming from excess monetary growth. The main conclusions from this chapter are as follows:

- Overall, the money market in the euro area is in broad equilibrium, thus signaling that medium-term inflation pressures are unlikely to arise from an accumulated "monetary overhang." The results suggest that, although M3 has grown significantly over the past 18-24 months, this increase was, to a large extent, explained by developments in prices, GDP, and by interest rates;

- The assumptions used in the derivation of money gap measures are crucial for the results and hence a careful analysis of the conditions in the money market is prudent. One key assumption, that is difficult to pin down accurately—due to uncertainties regarding its size and source—is the velocity trend for the euro area. It is shown that alternative models and assumptions regarding velocity trends can imply a range of reference values for M3 growth but overall these results suggest a reference value in the order of 5 percent—with a large band of uncertainty surrounding this estimate—compared with 4½ percent used by the ECB;

- These uncertainties which are likely to become even more evident in the near future, during the changeover period of the euro, raise a number of questions regarding the ability of the ECB to effectively communicate information from the first pillar to the public. Hence, possible erratic movements in M3 growth over the next several months should be treated with caution.

B. Identifying A Reference Value for Money Growth

6. This section compares four methods for deriving a trend money growth rate or reference value for the euro-area M3. If money has any role, in terms of predictive power over future inflation, these trend money growth measures could be used to define useful indicators of excess money growth. Four different methods for identifying trend money growth are presented here: (i) the reference value for M3 growth announced by the ECB; (ii) a flexible velocity trend alternative to the ECB's reference value as proposed by McCallum (1988, 1993); (iii) an estimate of trend money growth based on an unobserved component model; and, (iv) a measure of trend money growth based on a money demand model.

7. The results of applying these methods are presented in Figure 1 (middle panel) and a detailed explanation of the derivation follows in this section. The ECB's reference value is

compared with the flexible velocity trend alternative, the trend extracted using the unobserved component model, and finally the equilibrium money growth path obtained from the money demand model. The ECB's reference value for M3 growth is estimated at about 4½ percent. Taking into account of velocity changes—using McCallum's method—implies a reference value closer to 5 percent. This is corroborated by the estimation of the unobserved component model. Instead, the money demand models imply a wide range for M3 trend growth of about 3¾-5 percent based on a range of estimates of trend money velocity in the euro area.

Estimation using the quantity theory identity

8. Both the ECB's methodology for estimating the reference value and McCallum's formula use the quantity theory identity as a starting point and hence require assumptions regarding the trend growth for real output growth, prices, and velocity of money.[3] The basic difference between the two methods is that, in deriving the reference value for M3 growth, the ECB assumes a constant velocity trend whereas McCallum's formula estimates the velocity trend in terms of lagged (recent) values of money velocity; the advantage of the latter is that it puts more weight on more recent developments in money velocity and discounts past trends (both are compared in the middle panel of Figure 1).

9. The ECB's reference value for nominal M3 growth is based on real potential output growth in the range of 2–2½ percent, inflation below 2 percent over the medium-run, and a constant rate of decline in M3 velocity in the range of ½–1 percent. Taking mid-range values for potential output growth (2¼ percent), inflation (1½ percent), and velocity growth (-¾ percent), these values imply a reference value of 4½ percent.

10. The approach suggested by McCallum allows for a flexible velocity trend defined in terms of a moving average of lagged values of money velocity. This alternative reference value is calculated using the same values for output growth and inflation but a moving average of velocity over the 16 preceding quarters. According to this estimate the reference value appears to have increased following an acceleration in the (negative) velocity trend after 1999.

Estimation using an unobserved component model

11. Money is modeled as the sum of trend money growth, which is unobserved, and of an irregular component. An assumption is made regarding the specification of the trend process

[3] In logs the rate of change of money growth can be expressed in terms of the rate of growth of potential GDP, long-run inflation and velocity, or, $\Delta m^* = \Delta y^* + \Delta p^* - \Delta v^*$.

and such a model can be estimated with the Kalman filter.[4] This "agnostic" approach to the measurement of the money gap allows us to freely estimate a (flexible) trend for money without the need to make any assumptions regarding potential GDP growth, long-run inflation, or velocity trend.

12. Estimation of the trend based on the unobserved component model requires knowledge of the model parameters. To simplify the analysis we impose specific parameters for the unobserved component model in such a way that the trend extracted with this method is equivalent to a the trend obtained through a Hodrick-Prescott (HP) filter.[5] The results from this model also point to a higher trend growth compared with the ECB's reference value of the order of 5 percent.

The money demand model

13. Finally, a long-run (real) money demand model for the euro area is used to measure the "desired" money demand stock at given levels of real GDP and the interest rate.[6] The econometric analysis carried out for this paper shows that this relationship holds in the long run. Such a relationship suggests that—in steady state when the interest rate is unchanged—if prices and GDP are growing on a steady path consistent with potential GDP growth and the Central Bank's inflation target, money demand should also grow steadily. In the long run nominal money supply should also grow at that same rate, although short-run deviations can persist for some time. Assuming that interest rates remain unchanged, velocity will only change proportionally to potential (or long-run) GDP growth if the income elasticity of money demand is different than one.[7]

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[4] Specifically, $m_t = m_t^* + \xi_t$, where m* denotes the trend money growth and is presumed to follow an autoregressive process, $m_t^* = \delta_1 m_{t-1}^* + \delta_2 m_{t-2}^* + \varepsilon_t$, and ξ_t is an irregular component.

[5] For a given set of parameter estimates (δ_1=2, δ_2=-1 and $var(\xi)/var(\varepsilon)$=1600) this model is equivalent to the HP filter (see Hodrick and Prescott, 1980, and Harvey and Jaeger,1993, for example).

[6] A standard money demand equations in logs has the form, $m^d - p = \alpha_0 y - \alpha_1 R$, where p is the (log) GDP deflator, y is (log) GDP, and R is a measure for the opportunity cost of holding money.

[7] By definition velocity is given by, $v \equiv p + y - m = (1 - \alpha_0) y - \alpha_1 R$,which in growth rates can be written as $\dot{v} = (1 - \alpha_0)\dot{y} - \alpha_1 \dot{R}$. However, assuming that interest rates remain unchanged, velocity will change proportionally to potential (or long-run) GDP growth if $\alpha_0 \neq 1$.

14. A number of studies have confirmed the existence of stable money demand equations for the euro area (Coenen and Vega, 1999, Brand and Cassola , 2000, for example). Using these estimated (long-run) money demand equations it is possible to calculate the "desired" money stock which can be used, in conjunction with the actual money stock, to summarize the conditions prevailing in the money market. Nevertheless, a number of issues need to be addressed which can influence critically these estimates. One, which is important for the derivation of the reference value, is the measurement of the long-run velocity trend.

15. One of the stylized facts for the euro area is the constant velocity decline observed over the last 20 years. Different explanations for this trend can be advanced and these have different modeling implications:

- Brand and Cassola (2000) argue that the finding of an income "elasticity" greater than unity accounts for the constant velocity decline in the euro area throughout the 1980s and 1990s. The reasons behind this could be the existence of wealth effects (i.e., money demand increasing faster than one would expect based on GDP growth). If that is true then in the absence of a proxy for wealth in the money demand equation, the scale variable also accounts for this "missing variable" and this is translated into an income elasticity greater than unity.

- A second possibility is that the velocity trend is due to a steady (accelerating, perhaps, because of a world growth differential vis-à-vis the euro area) increase in the demand for euro M3 by foreigners.[8] That may be difficult to model precisely, within a standard money demand model, although a deterministic trend could be used to capture the declining velocity trend given that such demand for M3 should be unrelated to euro-area GDP. If that is the case, an important question is whether that process could come to an end or whether the demand from abroad will continue to grow unabated; the introduction of euro notes and coins may—combined perhaps with the adoption of the euro as a reserve currency—contribute to such a development. A deterministic trend is not ideal for capturing the "true" data generating process given that demand for euro outside the euro area may fluctuate considerably. However, it can be used as a good proxy for world GDP, for example, and may provide a more reliable estimate for M3 demand in the event of a idiosyncratic downturn in the euro area.

[8] According to estimates by the Deutsche Bundesbank, in the mid 1990s, 30-40 percent of all the DM banknotes were held abroad. Although, estimates for other currencies are not available it is certain that smaller quantities of other currencies may also be circulating outside the euro area (see Box 1, of the ECB's Monthly Bulletin, September, 2001, for a discussion).

- On the other hand, the ECB admits that there are also good reasons to expect a reversal in this trend, for example, as a result of improvements in payment technologies and/or the disintermediation process taking place in the euro area.

- Finally, the negative velocity trend in the euro area could be the result of declining inflation over the last 20 years. If that is the case, inflation could also be included in the money demand equation although the trend in nominal interest rates should explain part of the long disinflation process over the 1980s and 1990s and may be sufficient.

A vector autoregressive (VAR) model is constructed by including the following euro-area aggregates: the log of real money (M3), the log of real GDP, the short term interest rate (s), a long-term interest rate (l), and inflation defined as the (year-on-year) change in the log of the GDP deflator. This model includes a short- and long-term interest rate as it is found that such a specification provides a better model in terms of statistical properties. The data are basically the same as in Brand and Cassola (2000) but they have been extended to cover the period up to 2000Q4.

16. The (long-run) money demand equation estimated by Brand and Cassola (2000) and the alternative ones estimated in this paper are then used to calculate indicators for excess liquidity for the euro area. [9] In particular:

- The actual Brand and Cassola (2000) equation is given by: $m-p=1.33y-1.60\ R_l$, where R_l stands for the long-term interest rate (henceforth denoted by BC model).

- Our estimated version of the Brand and Cassola (2000) model yielded the following relationship: $m-p=1.35y-0.6\ R_l$, where R_l stands for the long-term interest rate (denoted by BC'). [10]

- Finally, two alternative money demand models based on the models described above: $m-p=1.04y+0.06\ R_s - 0.47\ R_l - 0.001875t$ and $m-p=y+0.29\ R_s - 0.35\ R_l - 0.95\ \Delta 4p - 0.001875t$, where R_s stands for the short-term interest rate. The first allows for a deterministic trend while the second includes both a trend and inflation (denoted by "Md trend" and "Md trend, inflation", respectively). In addition, these specifications

[9] The long-run equations are identified using the Johansen procedure; see, for example, Johansen (1988a,b and 1995), Hendry (1995), Doornik and Hendry (1997), and references therein.

[10] The VAR model estimated by Brand and Cassola (2000) includes two lags of each variable. In contrast, the results reported here are based on a model estimated with five lags which are all found to be essential to provide a well-specified model.

allow for both the short- and long-term interest rate to affect long-run money demand.[11]

The last two specifications are preferred in terms of their statistical properties. These indicate that in the presence of a deterministic trend (and inflation), the income coefficient in the money demand equation is not statistically different from unity and that this is sufficient to describe the velocity trend in the euro area. Consequently, these results call into question the assertion that the declining money velocity is due to wealth effects—expressed in the model in terms of a high coefficient of GDP in the money demand equation.[12] Instead, an exogenous decline in velocity—possibly due to demand for euros by foreigners—could also explain this trend. Allowing this (deterministic) trend to be freely estimated reveals a possible range for the velocity trend between -0.8 to -1 percent. This, also, would be consistent with a reference value closer to 5 percent compared with the 4½ percent adopted by the ECB.

C. Assessing Inflationary Risks Based on the First Pillar

17. To assess the conditions in the money market it is necessary to develop indicators that measure the "money gap" or "monetary overhang" in the economy. Two classes of summary measures of excess money liquidity are discussed here; a detailed discussion and comparison of these indicators is presented in Masuch, Pill, and Willeke (2001). For consistency purposes we adopt the terminology of the ECB regarding the names of these indicators. In particular, the "money gap" is simply the difference between money supply and "trend" money stock defined in terms of a quantity theory equation (i.e., assuming GDP growth in line with potential GDP growth and a stable long-run inflation rate—presumably consistent with the central bank's medium term target; this was described in detail in the previous section.)[13] On the other hand, the concept of "monetary overhang" compares the actual money stock with the estimated stock of money demand and measures the excess liquidity in the economy based on the difference between how much money people would like to hold (for a given, current, GDP and interest rates) and how much money is circulating in the economy.

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[11] A discussion about the correct measure for the opportunity cost of holding broad money demand for the euro area can be found in Calza, Gerdesmeier and Levy (2001).

[12] The word elasticity is not used here since it is argued that the parameters in these equations can not, strictly speaking, be interpreted as elasticities (i.e., showing the responsiveness of one variable to a change in another keeping all other variables unchanged); this point is explained in more detail in the longer version of the paper.

[13] Other indicators, including the real money gap, are variations of the money gap and the discussion that follows also applies to these concepts.

18. Although there appear to be differences in terms of size, almost all indicators estimated here point to a closing of a (negative) gap by mid-2000 and, as a result of the decelerating money growth throughout the second half of 2000, a leveling of the money gap/overhang measures thereafter (Figure 1, lower panel). Assuming a slightly higher "equilibrium" inflation rate (of about 2½ percent) for the period 1994-97 would imply a higher trend growth of M3, and consequently a wider (more negative) money gap; this is also shown in the lower panel of Figure 1 (see reference value with break in inflation) for comparison purposes. Judging by these different measures, therefore, it appears that the money market is broadly in equilibrium and consequently it does not pose any risks to medium terms price stability.

19. Nonetheless, the derivation of these indicators is subject to a number of important caveats. In particular, to provide a measure of the money gap—using the ECB's reference value and McCallum's formula—a starting date, or base period, must be defined.[14] Figure 2 (top panel) plots the money gap constructed using different base periods. The chart reveals that knowledge of the "correct" base period—which, in principle, should be chosen to be consistent with a period of money market equilibrium—is key in the measurement of the money gap. Second, the assumption regarding the velocity trend is also very important and the resulting differences under alternative hypotheses are significant and impinge upon the measurement of the money gap. Figure 2 (middle panel) plots the money gap under three alternative assumptions regarding the velocity trend: two that assume alternative negative velocity trends (-¾ of 1 percent and -1¾ percent annual percent change) and another one for unchanged velocity. In contrast, extracting the trend through an unobserved component model seems to be a good alternative since it is free of any assumptions regarding the base period or velocity.

20. Figure 2 (lower panel) reveals differences among the monetary overhang indicators obtained using the money demand models described earlier. There appear to be significant differences between the indicators based on the preferred money demand specifications, reported in this paper, and the equations of Brand and Cassola. These differences are striking: a higher sensitivity of M3 to both the GDP and interest rates, in the Brand and Cassola model, explain the strong money demand since 1995 and hence the large (negative) monetary overhang in recent years—a period of declining interest rates and strong, uninterrupted GDP growth. This comparison highlights the importance of the money demand specification used in the derivation of the monetary overhang. Nevertheless, the preferred specifications seem to provide a reasonable (and stationary) measure for the euro area.

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[14] The money gap measures shown in Figure 1 (lower panel), plotted over the period 1994-2000, are constructed relative to 1994; implicitly, it is assumed, therefore, that the money gap was (close to) zero in the first quarter on 1994.

D. Conclusions and Policy Implications

21. The analysis presented in this chapter reveals that the money market is in broad equilibrium. Hence, medium-term inflation pressures are unlikely to arise from an accumulated "monetary overhang" in the euro area. Alternative summary measures of the conditions prevailing in the money market—including the money gap, and monetary overhang—are estimated and used in this analysis.

22. However, the derivation of these indicators is subject to a number of important caveats which are discussed in this chapter and hence a careful examination of the conditions prevailing in the money market is warranted. Such analysis, carried out in this chapter through the estimation of a money demand model, provides evidence regarding periods of disequilibria in the money market and information about the likely source and magnitude of the velocity trend in the euro area. Overall, the results reveal that the trend money growth for M3 is estimated to be somewhere in the range of 4½ –5 percent, hence slightly higher than the reference value of the ECB. All of methods for estimating money trend for the euro area corroborate with this evidence. In addition, it is shown that there is considerable uncertainty surrounding the estimated velocity trend which is crucial in this analysis.

23. Looking ahead, the analysis and public communication of first-pillar information—to an already skeptical audience—are likely to become more difficult for two reasons. First, the stability of long-run money demand could be undermined by velocity shocks (this would increase the uncertainty about the size of money gaps and monetary overhang measures). Second, if the ECB succeeds in preserving a low-inflation environment, shocks to velocity—for example due to shifts in demand for euro notes and coins—relative to shifts in the money demand would dominate, making the signal extraction problem faced by the ECB even more difficult.

24. Although the finding of a stable money demand justifies the strategy of the ECB, the uncertainties pertaining to the velocity trend would call for a less precise reference value, perhaps in the form of a monitoring range, or uncertainty bands, for M3 growth. Such a strategy would allow the ECB to easily discount erratic fluctuations in M3 growth and would contribute to a more effective communication of its policy intentions in the future. In addition, the ECB should play down the importance of deviations of M3 growth from the reference value and should instead concentrate on the presentation of deviations of the stock of M3 from its trend level. A presentation of a wide range of indicators—complemented by analysis of M3 components and analysis based on money demand models—is desirable given the weaknesses of these measures.

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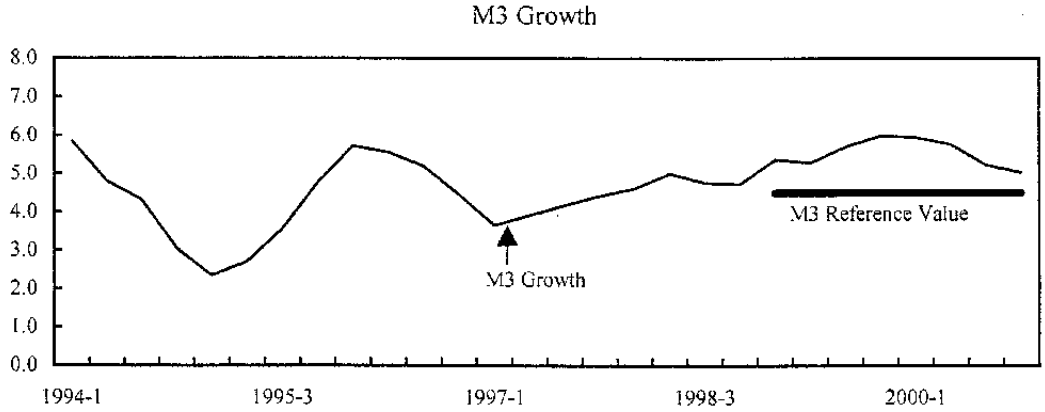
Table 1. Euro Area: The ECB's Monetary Policy Decisions

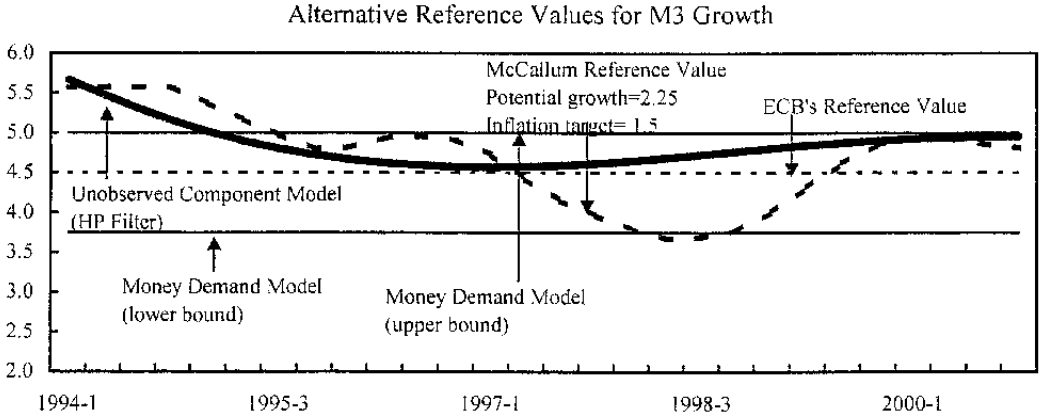
Date of policy decision	Main refinancing rate		Risks to medium-term price stability 1/	
	Level	Change	First-pillar assessment	Second-pillar assessment
4/8/99	2.50	-0.50	neutral	downside
11/4/99	3.00	+0.50	upside	neutral
2/3/00	3.25	+0.25	upside	upside
3/16/00	3.50	+0.25	upside	upside
4/27/00	3.75	+0.25	upside	upside
6/8/00	4.25	+0.50	upside	upside
8/31/00	4.50	+0.25	upside	upside
10/5/00	4.75	+0.25	upside	upside
5/10/01	4.50	-0.25	neutral	upside
8/30/01	4.25	-0.25	neutral	neutral
9/17/01	3.75	-0.50	neutral	neutral

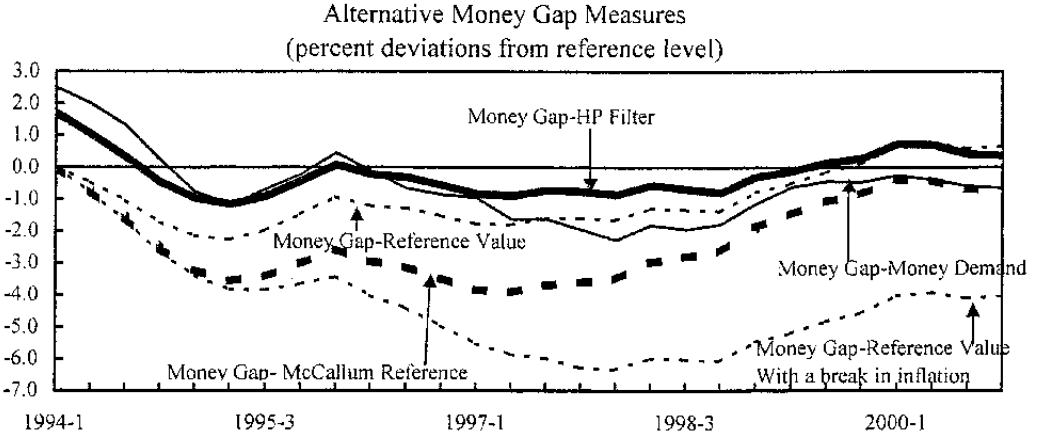
Sources: European Central Bank; and IMF staff interpretations.

1/ Staff interpretations based on various issues of ECB Monthly Bulletins.

Figure 1. Euro Area: M3 Growth

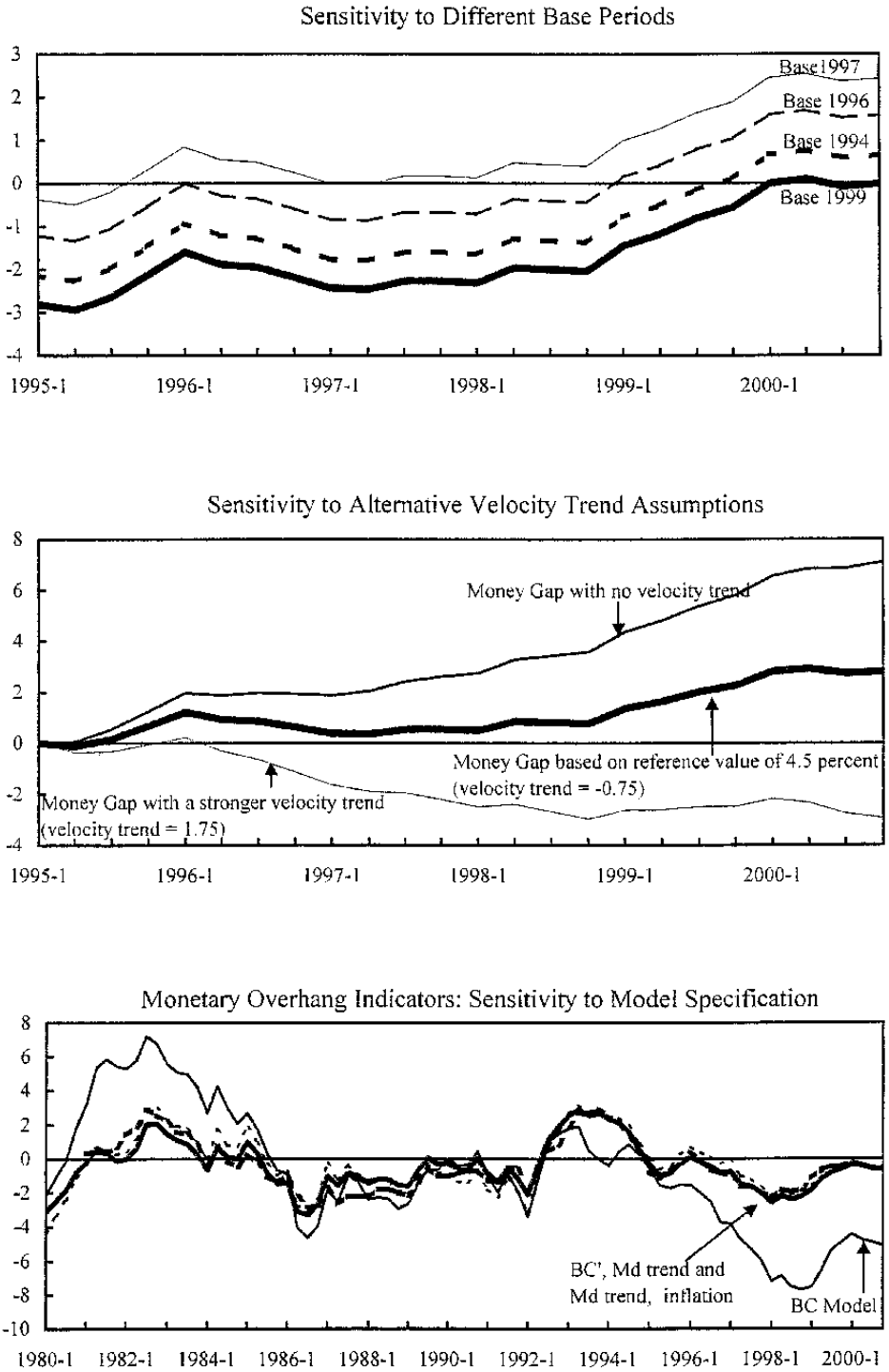






Source: European Central Bank and staff estimates.

Figure 2. Euro Area: Sensitivity of Money Gaps to Base Period, Velocity Trend, and Model Specification



Source: Staff estimates.

V. Cyclical Fiscal Policy Behavior in EU Countries[1]

A. Introduction and Summary

1. This chapter provides further background to the discussion of the Stability and Growth Pact (SGP) in the euro area report.[2] The chapter proceeds in four steps. First, it outlines a simple framework for studying fiscal policy behavior in response to output growth fluctuations. Second, it uses this framework to estimate EU countries' past cyclical fiscal policy responses to output growth fluctuations. Third, it presents evidence on features of EU countries' fiscal institutions that may help account for past cross-country differences in cyclical fiscal policy behavior. And fourth, the chapter briefly assesses the SGP's potential to rectify past flaws in fiscal policy behavior.

2. The chapter's main conclusions can be summarized in five bullet points:

- In most EU countries, past fiscal policy behavior delivered neither sustained fiscal discipline nor helped much in stabilizing the macroeconomy. In particular, discretionary fiscal policy responses in many countries were procyclical, muffling in part or fully the operation of automatic fiscal stabilizers.

- Fiscal policy behavior in most EU countries was not symmetric over the business cycle—procyclicality was more pronounced during "good economic times" (defined as periods of above-average GDP growth). This asymmetry bias implies an upward ratcheting of underlying fiscal deficits in good times, suggesting that procyclical policy behavior and lack of sustained fiscal discipline could represent two sides of the same coin.

- Procyclical fiscal policy behavior in many EU countries appears to be hardwired into present institutional arrangements. This is suggested by time series evidence based on (OECD) forecast errors for fiscal balances and real GDP growth. Forecast errors for fiscal balances in these countries respond only weakly to forecast errors for real GDP growth, consistent with the view that offsets to automatic fiscal stabilizers occurred in a quasi-automatic fashion rather than through fiscal actions based on a deliberate policy process.

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[1] Prepared by Albert Jaeger (Ajaeger@imf.org).

[2] A separate background paper on *Rules-Based Fiscal Policy and the Fiscal Framework in France, Germany, Italy, and Spain* discusses fiscal management and rules in the largest euro area countries. In-depth discussions of SGP rules and evolving surveillance under the SGP can be found in European Commission (2000, 2001).

- From a cross-country perspective, procyclical fiscal policy behavior in EU countries was associated with lax fiscal constraints on deficits and debt (proxied by accumulated public debt levels), the size of pay-as-you-go (PAYG) social insurance systems, and, to a lesser extent, the size of countries' lower government sectors.

- For many EU countries, the new "rules of the game" enshrined in the SGP hold the promise of a regime break with past patterns of fiscal laxity as well as procyclical fiscal policy behavior. However, some of the evidence presented in this chapter also suggests that locking in such a regime change may require an adaptation of longstanding institutional arrangements.

B. An Analytical Framework

3. The change in the actual fiscal balance as a percent of GDP (Δb_t) can be written as the sum of the change in the fiscal balance due to the operation of automatic fiscal stabilizers (Δba_t) in response to output growth fluctuations and the change in the fiscal balance due to other factors (Δbs_t):

(1) $\Delta b_t = \Delta ba_t + \Delta bs_t$,
(2) $\Delta ba_t = \alpha(\Delta y_t - \mu)$,

where $(\Delta y_t - \mu)$ is the deviation of real GDP growth from average growth or drift (μ), and the automatic fiscal response parameters α measures the automatic responses of the actual balance-GDP ratio to a 1 percentage point increase in real output growth (relative to drift).[3] In equation (1), the change in the structural balance (Δbs_t) is a catch-all term for the many other factors driving fiscal positions. The change in the structural balance can be decomposed into a component that picks up any discretionary responses to real GDP growth fluctuations and the remaining change in the structural component that is uncorrelated with real GDP growth fluctuations (Δbu_t):

(3) $\Delta bs_t = \beta(\Delta y_t - \mu) + \Delta bu_t$,

where the parameter β measures the "discretionary" response of the structural balance to real output growth fluctuations. The sign of the discretionary response parameter β can be used to classify changes in the structural balance as countercyclical (β positive) or procyclical (β negative).[4] Combining equations (1)-(3) yields:

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[3] To simplify the exposition, α is assumed to combine current as well as lagged responses.

[4] It is noteworthy that the interpretation of the "structural budget balance" as the "budgetary position that would be observed if the levels of actual and potential output coincided" relies on the implicit assumption that β is zero. For example, in the case of procyclical responses

(continued)

(4) $\Delta b_t = (\alpha + \beta)(\Delta y_t - \mu) + \Delta bu_t$.

4. In the empirical portion of the paper, it will be assumed that the automatic response parameter (α) is constant and known. Time series data on the fiscal balance and output growth fluctuations are used to infer information about the parameter β and the time series behavior of the autonomous (with respect to output growth) changes in the budget balance (Δbu_t). As regards the latter term, all regressions below assume that this term is white noise.[5]

5. The framework outlined in this section can also be used to shed light on two additional issues: First, is fiscal policy behavior symmetric with respect to fast and slow output growth? And second, to what extent is procyclical fiscal policy behavior ingrained in a country's fiscal institutions in the sense that discretionary policy responses are quasi-automatic rather than the result of deliberate policy making?

6. To test for possible asymmetries in the discretionary response of fiscal policy to output growth fluctuations, equation (4) can be augmented to allow for different response parameters depending on whether output growth relative to drift ($\Delta y_t - \mu$) takes positive or negative values:

(5) $\Delta b_t = (\alpha + \beta^+)(\Delta y_t - \mu)(I_t^+) + (\alpha + \beta^-)(\Delta y_t - \mu)(I_t^-) + \Delta bu_t$

where I_t is an indicator function, defined as:

(6)
$$I_t^+ = 1 \text{ if } (\Delta y_t - \mu) \geq 0 \quad \text{and } I_t^+ = 0 \text{ if } (\Delta y_t - \mu) < 0$$
$$I_t^- = 1 \text{ if } (\Delta y_t - \mu) < 0 \quad \text{and } I_t^- = 1 \text{ if } (\Delta y_t - \mu) \geq 0.$$

7. A test of how ingrained procyclical fiscal policy responses are in fiscal institutions can be based on readily available one-year-ahead forecast errors for the change in the fiscal balance ($\Delta b_t - {}_f\Delta b_t$) and for real GDP growth ($\Delta y_t - {}_f\Delta y_t$). Using equation (3), these forecast errors are related as:

(7) $(\Delta b_t - {}_f\Delta b_t) = (\alpha+\beta)(\Delta y_t - {}_f\Delta y_t) + (\Delta bu_t - {}_f\Delta bu_t)$.

($\beta<0$) the structural balance overstates the soundness of the underlying fiscal position in the case of a negative output gap.

[5] Tests for autocorrelation in the error term suggested that this assumption is appropriate for most regressions. In principle, (Δbu_t) could be modeled as a more general ARMA process to capture any serial autocorrelation.

8. Since the fiscal policy surprise ($\Delta bu_t - {}_f\Delta bu_t$) is uncorrelated with the forecast error for output growth, a regression based on (7) can be used to estimate ($\alpha+\beta$). The estimated parameter combines the (current) automatic fiscal stabilizer response and the (current) intra-year fiscal policy response to the GDP growth surprise. Assuming the (current) automatic fiscal stabilizer response is known, an estimate of β can be recovered and used as a proxy for the intra-year fiscal policy response to a real GDP growth surprise. If the estimate of β offsets the automatic stabilizer response, this can be interpreted as evidence that the intra-year fiscal policy response is procyclical and likely to reflect fiscal institutions bent on meeting nominal balance targets.

9. Two features of the framework laid out in this section—the use of first differences of fiscal variables; and the absence of cyclical output gaps—warrant brief comment:

- The framework's use of first differences (instead of levels) of fiscal variables allows to apply standard variance-covariance analysis tools. In most industrial countries, fiscal variables appear to be nonstationary in levels during the last few decades, rendering the application of standard statistical tools doubtful.

- The framework uses GDP growth rates instead of output gaps as indicators of output fluctuations. This follows a suggestion by Blanchard (1990, p. 6) who argued that adopting a "marginal approach" to analyzing automatic fiscal stabilizers based on GDP growth rates allows to avoid controversial measurement issues regarding the output gap.

C. Past Cyclical Fiscal Policy Behavior: Time Series Evidence

10. The time series analysis uses data for general government balances (as a percent of nominal GDP)[6] and real GDP growth covering 1978-2000. Two reasons account for not using available time series before 1978. First, fiscal policy behavior in several industrial countries underwent a regime break during the 1970s.[7] And second, discarding observations before 1978 also appears appropriate in view of the analysis' assumption of a constant parameter value for the automatic fiscal stabilizer coefficient α. The size of automatic

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[6] There is a break in EU countries' fiscal data in 1995 due to the adoption of the European System of Accounts (ESA). The regressions below use first-differenced data for 1978-95, which are based on the pre-ESA data, and first-differenced data for 1996-00 based on ESA. The fiscal data for 2000 in the regressions exclude UMTS license receipts in the case of Germany, Spain, Italy, the Netherlands, Austria, and the United Kingdom. Luxembourg's general government data for1988-89 represent staff estimates.

[7] In the case of Germany, formal econometric tests support the hypothesis of a structural break in cyclical fiscal policy behavior in 1978. See IMF (1998a, p. 24).

stabilizers depends sensitively on the size of the revenue-GDP ratios, which rose sharply in many industrial countries during the 1970s.

11. The constant numerical values for the automatic fiscal stabilizer coefficient α (including current and lagged effects) are shown in Table 1. These constant values are based on staff estimates of automatic stabilizer responses used in the context of estimating structural balance positions.[8] A breakdown of the automatic balance response into contributions of revenue and expenditure (first decomposition shown in Table 1), suggests that revenue account for most of the automatic response to output fluctuations. In particular, for the euro area as a whole, about 85 percent of the automatic balance response is due to revenues while the remainder reflects the automatic response of unemployment benefits to the cycle, which, however, occurs partly with a lag. The breakdown of the automatic balance response into contributions of current and lagged responses (second decomposition shown in Table 1) indicates that lagged responses account for a small portion (7 percent) of the overall automatic stabilizer response.

12. The drift term (μ) of GDP growth was assumed to be constant for all countries during 1978-2000 except for Ireland, Luxembourg, and Japan. In the case of the latter countries, the drift term was approximated by Hodrick-Prescott (HP) filter estimates.[9]

13. The regression evidence clearly confirms the—by now conventional—view that fiscal policy behavior in most EU countries during the last two decades had a strong procyclical bent (Table 2).[10] The estimated discretionary fiscal response coefficient (including current and lagged responses) to output growth is negative for all EU countries except Denmark, Finland, and Sweden. Thus, in all EU countries apart from the three Scandinavian countries, the operation of automatic fiscal stabilizers was at least in part offset by discretionary actions. In the case of four EU countries (Belgium, Germany, Ireland, Italy), the overall net fiscal response (defined as the sum of the total automatic fiscal stabilizer and discretionary response coefficients) to real output growth fluctuations was negative (Figure 1).

14. Turning to the regression results that allow for different discretionary responses depending on whether output growth exceeds or falls short of average, the regression results suggest that procyclical behavior is overwhelmingly a characteristic of high-growth episodes (Table 2). In fact, the results for only one EU country (Finland) suggest that discretionary

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[8] The automatic revenue responses draw largely on OECD work on revenue elasticities in industrial countries, see Chouraqui et.al. (1990) and Van den Noord (2000). The European Commission's estimates of automatic fiscal stabilizers also draw on OECD work.

[9] The HP smoothing constant was fixed at 400.

[10] Replacing the balance by the primary balance-GDP ratio—thus excluding interest payments on debt—does not materially affect the regression results.

fiscal policy responded countercyclically during high-growth episodes (Figure 2). By contrast, during low-growth episodes, procyclical responses appear to be either subdued or discretionary fiscal policy even pursued a pronounced countercyclical stance (France, Denmark, and Sweden).

15. Finally, to shed light on the intra-year fiscal policy response to GDP growth surprises, regression (7) was run for selected EU countries (Table 3). The regressions use forecast errors based on one-year-ahead (December) OECD forecasts spanning 1978-2000 (for the major industrial countries) or 1983-2000 (for all other countries). The results indicate that countries that are prone to strong procyclical behavior (as indicated by the results in Table 2) are also prone to offsetting automatic fiscal stabilizers in response to GDP growth surprises. However, regressions that allow for asymmetric responses to negative and positive forecast errors for GDP growth (not reported) suggest that procyclical behavior is largely concentrated in years with positive GDP growth surprises. Put differently, countries largely allow automatic fiscal stabilizers to work in years with negative GDP growth surprises.

16. In four cases (United States, Japan, United Kingdom, and Sweden) the estimated intra-year fiscal policy responses have a positive sign, pointing *prima facie* to anticyclical fiscal policy actions to growth surprises. However, while this finding could indeed be due to unusually quick anticyclical policy action in these countries, a more plausible alternative explanation might be that the finding reflects underestimation of the size of automatic fiscal stabilizers in countries that have experienced asset price cycles over the last two decades. The latter interpretation would be consistent with work by Eschenbach and Schuknecht (2001), who find in case study for Sweden that asset price cycles may have boosted automatic fiscal stabilizers far above the conventional estimates reported in Table 1.

D. Past Cyclical Fiscal Policy Behavior: Cross-Country Evidence

17. While procyclical fiscal policy behavior appears to characterize the fiscal data of most EU countries, the previous section's analysis also highlights the considerable heterogeneity in cyclical fiscal policy behavior across countries. What factors or institutional arrangements could explain these cross-country differences? Following loosely in the footsteps of recent literature on the roots of European unemployment,[11] it is useful to think about fiscal policy behavior as the outcome of the interaction between fiscal institutions (formal and informal constraints on fiscal policy behavior) and the economic environment (shocks). Assuming the economic environment during the last two decades was roughly similar across EU countries, cross-country differences in fiscal institutions should account for differences in cyclical policy behavior.

[11] See, for example, Blanchard and Wolfers (1999).

18. Three types of indicators capturing fiscal institutions that could influence fiscal policy behavior in response to output fluctuations could be of particular interest:

- The nature of (formal or informal) constraints on the size of fiscal deficits. With lax fiscal constraints and a sizeable public debt, procyclical fiscal policy behavior could arise as a by-product of a vulnerable fiscal positions. For example, fiscal deficits may have to be contained during cyclical downswings to assuage capital markets, while there may be few (political) incentives to roll back indebtedness during cyclical expansions. The empirical analysis uses the observed levels of gross public debt (as a percent of GDP) in 2000 as a proxy of the laxity of past constraints on fiscal policy.

- The use of pay-as-you-go (PAYG) principles to finance social security systems. For example, strict PAYG (with no transfers from other budgets) would mimic fiscal policy behavior under a strict balanced-budget rule because deviations of revenue from spending due to output growth fluctuations would have to be offset by immediate adjustments in the social contribution rate or spending measures. In the empirical analysis, the size of social security systems—as measured by social security contributions as a percent of GDP—is used as a rough proxy of the importance of PAYG financing within the general government.[12]

- The degree of decentralization of the general government. Lower governments endowed with their own sources of revenue are more likely to adopt fiscal policy behavior that mimics (procyclical) balanced-budget rules than central governments, in part because shocks to output growth at the lower government level are likely to be more persistent than at the national level.[13] As a proxy of the importance of fiscal decentralization, the analysis below will use the size of the local government sector as measured by total spending (as a percent of GDP).

19. The cross-section evidence on the degree of procyclical behavior (proxied by the estimates of fiscal offset coefficients reported in Table 2) and the level of gross public debt in 2000 is summarized in the first panel of Figure 3. Among EU countries, three cases that combine strongly procyclical behavior with high debt levels stand out: Italy, Belgium, and Greece. At the same time, lower levels of gross debt in the range of 40-60 percent of GDP appear to be compatible with a rather wide range of cyclical fiscal policy behavior. Thus, this cursory cross-country evidence appears to suggest that while lax fiscal institutions appear to

[12] Social contributions as a measure of the size of PAYG systems are likely to be unsatisfactory in some cases. For example, the financing of Luxembourg's social insurance system is based on smoothing social contribution rates over a seven-year horizon, and financing shortfalls or surpluses are reflected in social insurance reserve funds.

[13] See Blanchard and Katz (1992) for a study finding high persistence of regional growth fluctuations in the United States.

be a sufficient condition for procyclical fiscal policy behavior, this type of behavior may as well arise under fiscal institutions that put relatively tight limits on public debt accumulation. For example, among euro area countries, Germany, Austria, and the Netherlands appear to have, over the last two decades, adopted a *de facto* culture of targeting nominal deficits—reflected in procyclical behavior and low variability of fiscal positions (in Germany's case notwithstanding the large fiscal shock of unification).

20. The cross-country evidence on procyclical fiscal policy behavior and the size of the PAYG social insurance system suggests that larger-sized PAYG systems are indeed associated with more pronounced procyclical fiscal policy behavior (middle panel in Figure 3). Box 1 contains a case study of PAYG financing of social insurance in Germany and its impact on the cyclical behavior of Germany's fiscal policy; the box also illustrates the option of cyclical reserve funding of social insurance to avoid the straightjacket constraints of PAYG financing.

21. Perhaps contrary to conventional wisdom, the cross-country evidence for all EU countries summarized in the bottom panel of Figure 3 suggests that large local government sectors need not necessarily be associated with an increased tendency to procyclical fiscal policy behavior. However, this result appears to largely reflect the rather unique status of the Scandinavian EU member countries—Denmark, Finland, and Sweden—all of which have relatively large lower government sectors that appear not to have stood in the way of allowing free play to automatic fiscal stabilizers, perhaps reflecting the structure of intergovernmental transfer systems. Excluding the Scandinavian countries from the cross-country sample produces the (expected) downward sloping relationship—countries are more prone to procyclical policy behavior the larger the size of the lower government sector.

E. Will the SGP Help Overcome Procyclical Behavior?

22. Views on how to ensure simultaneously fiscal discipline and a meaningful stabilization role for fiscal policy are evolving. A succinct summary in terms of the framework in Section 2 and taking account of different types of shocks could run as follows:

- Biases in the political process require tight constraints on the term (Δbu_t) to keep the underlying balance position in "sustainable territory." The Maastricht Treaty's precepts for avoiding excessive fiscal deficits—further fleshed out in the Stability and Growth Pact (SGP)—squarely aim at preventing backsliding on fiscal probity. In particular, the SGP obliges member states to reach and "*...adhere to the medium-term objective of budgetary positions close to balance or in surplus.*"[14]

- In response to "normally-sized" demand shocks (i.e. transitory shocks to the level of output) where the sources of shocks are difficult to identify, the automatic fiscal

[14] EC Council Regulation No. 1466/97 of July 7, 1997.

stabilizers should be allowed to operate fully and symmetrically, i.e. $\beta = \beta^{+} = \beta^{-} = 0$. In this context, the SGP states that reaching the medium-term balance objective would "*... allow member states to deal with normal cyclical fluctuations while keeping the government deficit within the 3 percent of GDP reference value.*"[15]

- In response to "large-sized" demand shocks where the sources of shocks represent readily identifiable events, the automatic fiscal stabilizers should probably be reinforced by specific policies that would be reflected in positive values for β (if serious concerns about debt dynamics do not argue otherwise).[16]

- In the case of supply shocks (i.e. permanent shocks that affect the long-run level of output), the automatic fiscal stabilizers should be offset by allowing for negative values of β. In the case of supply shocks, the operation of automatic fiscal stabilizers is not desirable because they get in the way of the needed adjustment of actual output to the new level of potential output. It is noteworthy that disentangling demand and supply shocks is difficult, particularly in the short run.

23. In sum, the SGP squarely addresses the need to constrain fiscal policy while leaving flexibility to stabilize demand-side driven output fluctuations. However, the SGP leaves unclear what countries should do if they have not reached their medium-term balance objectives and are faced with a sharp unexpected growth slowdown— the present situation in the three largest euro-area members (Germany, France, and Italy). Policy makers in the EU have generally adopted the view that SGP-delinquent countries should be held to the nominal balance (as a percent of GDP) targets contained in the Stability Programs (SPs). If growth slows unexpectedly, this view would call for procyclical spending or revenue adjustments in these countries. An alternative view would try to safeguard the operation of automatic fiscal stabilizers on the revenue side and allow balances to adjust to growth surprises. At the same time, countries could be held accountable for reaching the nominal spending paths laid out in their SPs to ensure that countries stay on the transition paths to their medium-term balance objectives.

24. Making the SGP work in the sense of preserving the functioning of automatic fiscal stabilizers may also require institutional reforms. The empirical evidence presented in this chapter points to two features of fiscal systems in many EU countries that should receive some attention. First, it might be useful to examine the option of setting up reserve funds that allow for more cyclical variation in social insurance funds' fiscal position—with the idea of providing (cyclical) breathing space from the straightjacket rule of PAYG financing. Second, in countries with large local government sectors, there may be ways to coordinate better

[15] EC Council Regulation No. 1466/97 of July 7, 1997.

[16] The distinction between "normally-sized" and "large-sized" shocks and their implications for macroeconomic stabilization policies is discussed in Blanchard and Watson (1986).

fiscal policy behavior across different government units without cutting into the benefits of fiscal decentralization. But reforms of long-standing fiscal institutions are likely to be difficult—with many devils hiding in the details. However, a more cycle friendly fiscal policy would provide EMU with a much-needed stabilization mechanism, particularly when the area is hit by large common demand shocks.

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Box 1: Germany's PAYG System and Procyclical Behavior

In 2000, spending by Germany's social insurance sector— which covers pensions, health care, long-term care, and unemployment insurance—amounted to 21.4 percent of GDP, accounting for about 45 percent of total general government spending (excluding UMTS receipts). Social insurance is overwhelmingly financed by social security contributions—yielding some 18 percent of GDP—while the remainder reflects budget transfers to the social insurance sector. In view of its size, social insurance accounts for a significant portion of the general government's automatic fiscal stabilizers. Assuming an elasticity of social contributions with respect to output growth of 0.7 and taking account of the automatic countercyclical behavior of unemployment benefits, the current automatic response of the social insurance balance should be about 0.20 and the lagged automatic response should be around 0.05. Thus, with an overall automatic response estimate of 0.25, the social insurance system should account for almost half of the automatic fiscal stabilizers of Germany's general government sector (0.55).

However, in practice the social insurance system is financed based on rules that closely approximate the pay-as-you-go (PAYG) principle. For example, in the case of public pensions, there is an automatic feedback in place to finance shortfalls in overall pension finances (which was formalized by the *1992 Pension Reform Act*) through a mixture of increases in contribution rates, slower adjustment of pension payouts, and increased transfers from the federal government. Although the public pension fund maintains a liquid fluctuation reserve, this reserve is not used to smooth cyclical fluctuations in pension revenue.

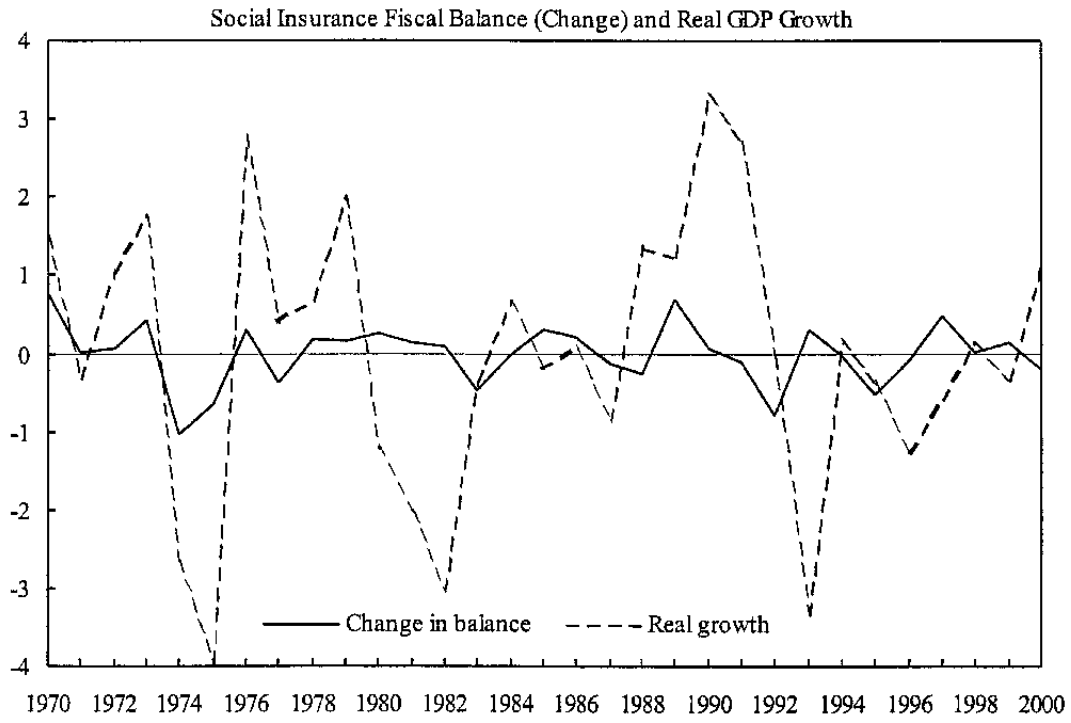
Turning to the time series evidence, the PAYG nature of Germany's financing of social insurance is well illustrated by plots of the change in the balance of the social insurance system and the real GDP growth rate (adjusted for drift) during 1971-2000 (see Box 1 Figure 1, first panel). A marked response of the social insurance balance to the fluctuations in GDP growth can only be detected during the recession triggered by the first oil shock. Regressing the change in the social insurance balance ($\Delta bsoc_t$) on current and lagged real GDP growth during 1978-2000 gives (with t-statistics in parentheses):

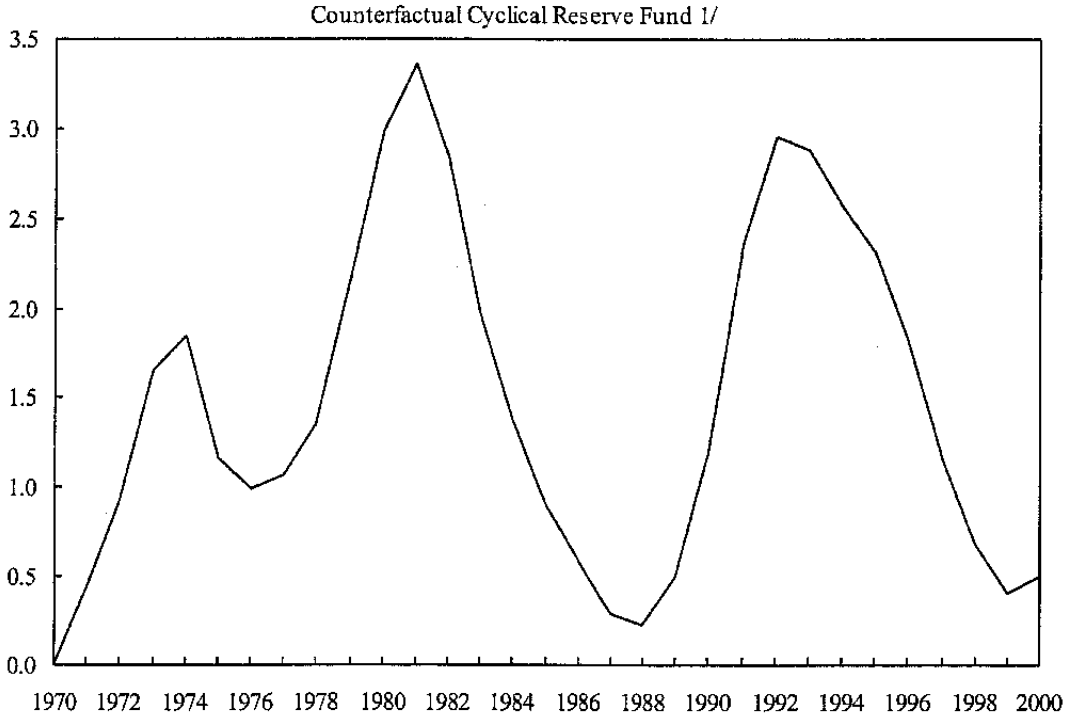
$$\Delta bsoc_t = \underset{(0.39)}{-0.02[\Delta y_t - \mu]} + \underset{(0.26)}{0.01[\Delta y_{t-1} - \mu]} \qquad R^2 = 0.01 \quad DW=2.03$$

The estimated response coefficients are close to zero, consistent with the PAYG financing principle.

The second panel of Box 1 Figure 1 presents the results of a counterfactual experiment, where the social insurance funds accumulate and run down a cyclical reserve fund that fully accommodates the automatic fiscal stabilizers during 1971-2000. This counterfactual experiment suggests that such a reserve fund would need to be able to accommodate swings in social insurance finances amounting to some 3 percent of GDP.

Box 1 Figure 1. Germany: Social Insurance Finances





Sources: WEO database; and staff estimates.
1/ In percent of GDP.

Table 1. EU Countries: Estimates of Automatic Responses of General Government Balance-GDP Ratio to Real GDP Growth Fluctuations

Country	Automatic response parameter estimates 1/				
		First decomposition:		Second decomposition:	
	Balance	Revenue	Expenditure	Current	Lagged
Germany	0.55	0.44	0.12	0.50	0.05
France	0.56	0.48	0.08	0.52	0.05
Italy	0.37	0.36	0.01	0.34	0.03
Spain	0.60	0.50	0.10	0.57	0.03
				0.00	0.00
Austria	0.49	0.45	0.04	0.47	0.02
Belgium	0.52	0.50	0.02	0.51	0.01
Finland	0.60	0.51	0.08	0.56	0.03
Greece	0.36	0.36	0.00	0.34	0.02
Ireland	0.50	0.42	0.08	0.48	0.02
Luxembourg	0.45	0.45	0.00	0.45	0.00
Netherlands	0.71	0.60	0.11	0.63	0.08
Portugal	0.43	0.39	0.04	0.41	0.02
United Kingdom	0.74	0.63	0.11	0.30	0.44
Denmark	0.74	0.53	0.21	0.58	0.16
Sweden	1.08	0.77	0.31	0.96	0.12
Memorandum items:					
EMU countries 2/	0.53	0.45	0.08	0.48	0.04
EU countries 2/	0.58	0.49	0.09	0.47	0.11
United States	0.35	0.32	0.03	0.32	0.04
Japan	0.37	0.36	0.02	0.36	0.01
Canada	0.64	0.49	0.15	0.58	0.06

Source: Staff estimates.

1/ Staff estimates of automatic or built-in percentage point change in the ratio of general government balance to GDP in response to a 1 percentage point increase in real GDP. The calculation of these parameter estimates is described in IMF (1998b).
2/ Weighted averages.

Table 2. EU Countries: Estimates of Discretionary Responses of General Government Balance-GDP Ratio to Real GDP Growth Fluctuations, 1978-2000

Country	Discretionary response parameter estimates 1/		
	All growth observations	High growth 2/ observations	Low Growth 3/ observations
Germany	-0.72	-0.98	-0.40
France	-0.22	-0.72	0.34
Italy	-0.55	-0.77	-0.29
Spain	-0.22	-0.58	0.15
Austria	-0.28	-0.35	-0.13
Belgium	-0.65	-0.81	-0.51
Finland	0.12	0.41	0.03
Greece	-0.25	-0.79	0.20
Ireland	-0.63	-1.00	-0.29
Luxembourg	-0.23	-0.15	-0.28
Netherlands	-0.41	-0.25	-0.49
Portugal	-0.25	-0.83	0.23
United Kingdom	-0.26	-0.03	-0.27
Denmark	0.33	-0.10	0.69
Sweden	0.21	-0.70	0.76
Memorandum items:			
EMU countries 4/	-0.47	-0.75	-0.14
EU countries 4/	-0.40	-0.62	-0.12
United States	0.10	-0.47	0.46
Japan	0.15	0.39	-0.03
Canada	-0.12	-1.52	0.64

Source: Staff estimates.

1/ Estimates of discretionary percentage point change in the ratio of general government balance to GDP in response to a 1 percentage point increase in real GDP including current and lagged effects.
2/ Observations with GDP growth at or above period average.
3/ Observations with GDP growth below period average.
4/ Weighted average.

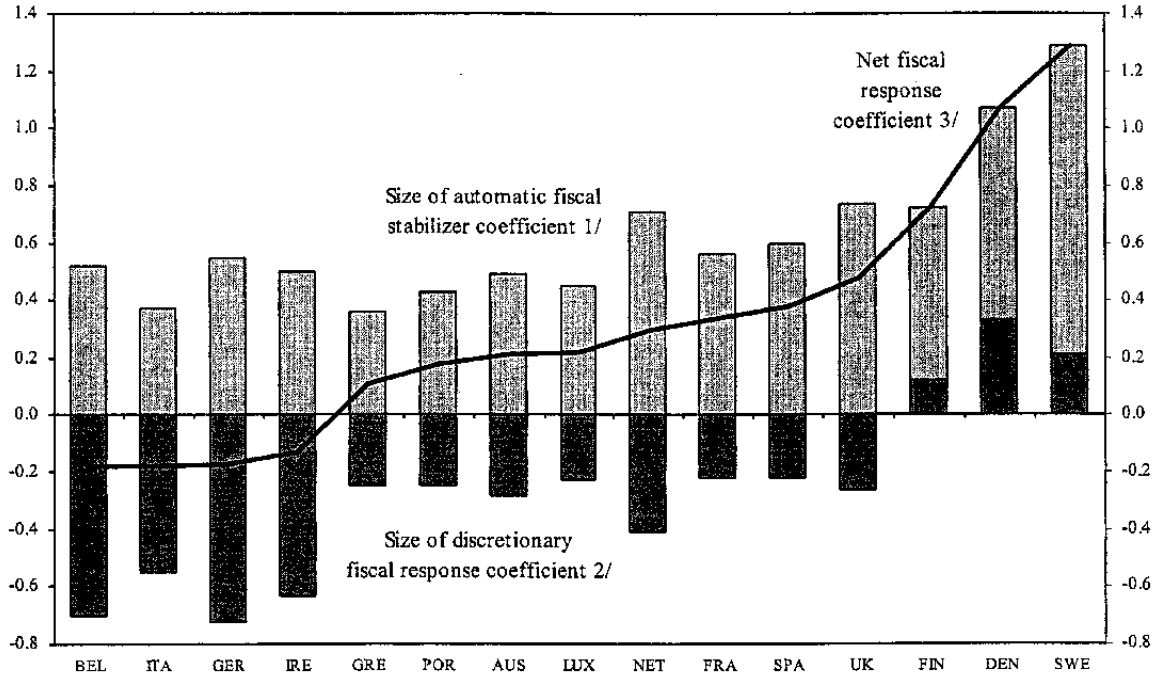
Table 3. EU Countries: Estimates of Responses of OECD Forecast Errors for General Government Balance-GDP Ratio to OECD Forecast Errors for Real GDP, 1978-2000 1/

Country	Response parameter estimates:		
	Combined response 2/	Automatic fiscal stabilizer 3/	Implied discretionary response 4/
Germany	0.08	0.50	-0.42
France	0.27	0.52	-0.25
Italy	0.10	0.34	-0.24
Austria	0.23	0.47	-0.24
Belgium	0.48	0.51	-0.03
Finland	0.45	0.56	-0.11
Netherlands	0.30	0.63	-0.33
United Kingdom	0.50	0.30	0.20
Denmark	0.45	0.58	-0.13
Sweden	1.37	0.96	0.41
Memorandum items:			
United States	0.65	0.32	0.33
Japan	0.96	0.36	0.60
Canada	0.52	0.58	-0.06

Sources: OECD forecasts from *OECD Economic Outlook*, December, consecutive issues; and. staff estimates.

1/ Time range for Austria, Belgium, Finland, and Netherlands is 1983-2000.
2/ Estimate of combined coefficient in equation (7).
3/ Automatic stabilizer coefficient (current) from Table 1.
4/ Calculated as difference between automatic stabilizer coefficent and combined response.

Figure 1. EU Countries: Cyclical Fiscal Policy Behavior



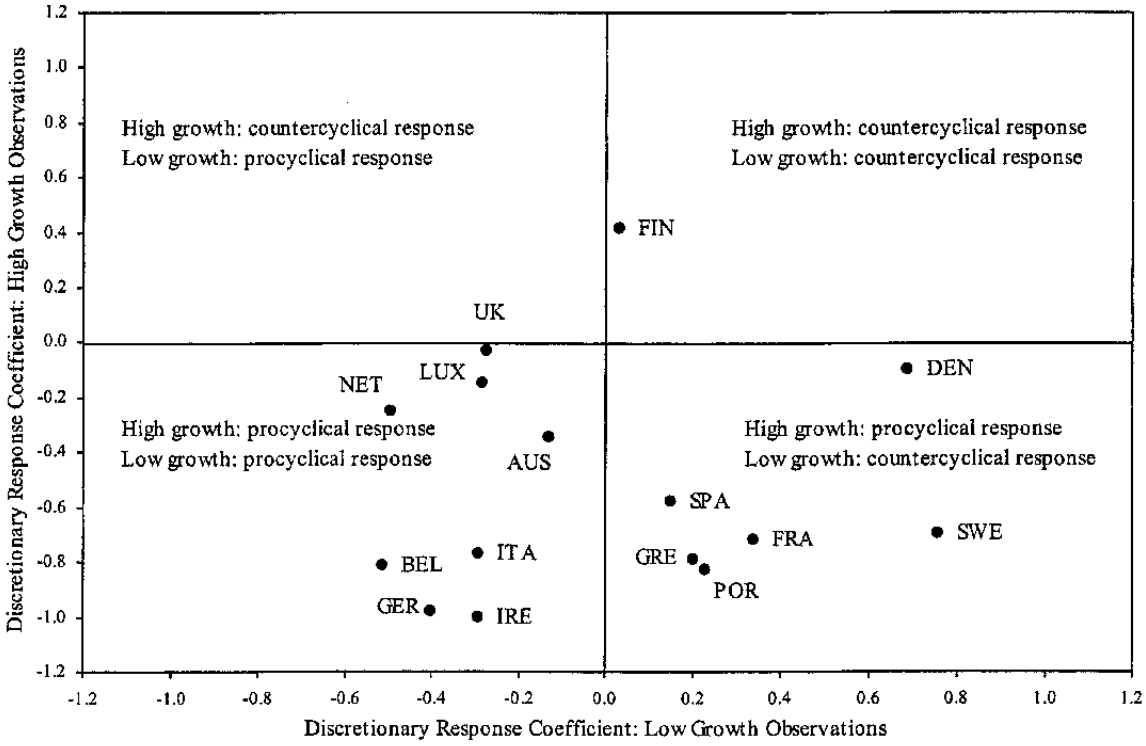
Sources: European Commission; and staff estimates.

1/ Automatic change in general government balance-GDP ratio in response to a 1 percentage point increase in real GDP growth.

2/ Discretionary change in general government balance-GDP ratio in response to a 1 percentage point increase in real GDP growth.

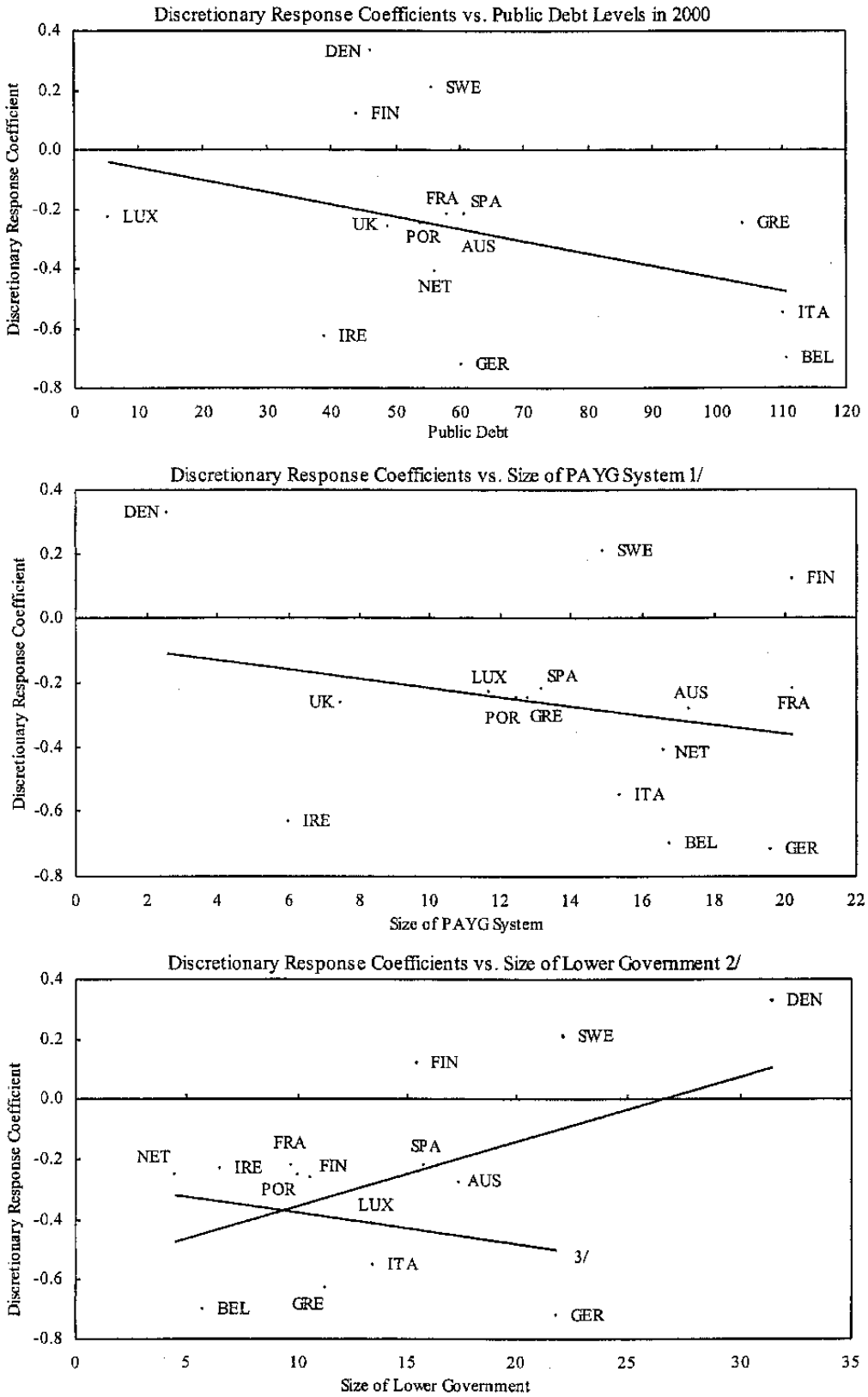
3/ Sum of automatic fiscal stabilizer and discretionary fiscal response coefficients.

Figure 2. EU Countries: Discretionary Fiscal Policy Responses In Different GDP Growth Regimes



Sources: Table 2; and staff estimates.

Figure 3. EU Countries: Cross-Country Evidence on Cyclical Fiscal Policy Behavior



Sources: IMF Government Finance Statistics (2000); European Commission; and staff estimates.

1/ Measured by social contributions as a percent of GDP.

2/ Spending by local governments as a percent of GDP.

3/ Trendline excludes Denmark, Finland, and Sweden.