E d i t o r i a l

An ealier version of the article contained in this Working Paper was presented at an internal seminar at the Oesterreichische Nationalbank in May 1995 which was held to strenghten research contacts between the two institutions.

In this paper Hans Groeneveld[1]) examines the link between Austrian inflation and national and Europe-wide monetary aggregates within the context of the P-star framework. To this end, he investigated the influence of domestic and European price gaps on domestic inflation over the period 1973/I - 1994/IV. The estimations suggest that the relative importance of national and European monetary conditions for detecting price trends in Austria has shifted in favour of the latter variable in the course of time. Hence, long before Austria decided to join the ERM, its path of inflation was largely determined by monetary factors on a European scale. The credible 'hard currency' concept of the Austrian monetary authorities together with the strong European orientation of Austria is presumably largely responsible for this.

Note: The views expressed in this paper are personal and do not necessarily reflect those of the Nederlandsche Bank or of the Oesterreichische Nationalbank.

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[1]) Monetary and Economic Policy Department, De Nederlandsche Bank NV, PO Box 98, 1000 AB Amsterdam, The Netherlands.

Hans Groeneveld
De Nederlandsche Bank

MONETARY SPILL-OVER EFFECTS IN THE ERM: THE CASE OF AUSTRIA, A FORMER SHADOW MEMBER

1. Introduction

In January 1995, Austria, Finland and Sweden joined the European Union. Unlike the other new entrants, Austria also decided to join the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS) as from 9 January 1995. This means that Austrian monetary policy will be predominantly aimed at keeping the schilling within the current fluctuation bands of this arrangement. The participation of Austria in the ERM did not necessitate fundamental changes in the preparation and implementation of monetary policy, because the main policy objective of the Austrian monetary authorities since the late 1970s has been to keep the value of the schilling within very narrow margins against the German mark [Hochreiter and Winckler (1995)][2]). Hence, the (intermediate) goal of Austrian monetary policy has actually been identical to that of monetary policy in other relatively small countries which joined the ERM at the start in 1979, e.g. Belgium and the Netherlands.

Although Austria has only recently become an 'active' member of the ERM, it is conceivable that its monetary tradition has rendered domestic price developments more sensitive to 'ERM-wide' rather than purely domestic monetary developments in the course of time. In a sense, this would be consistent with the theoretical notion that in countries with an exchange rate target, domestic money supply becomes fully endogenous under certain conditions. Moreover, Austria has also committed itself to the achievement of the convergence criteria laid down in the Maastricht Treaty. When Austria succeeds in meeting these conditions, it qualifies for participation in the third and final stage of Economic and Monetary Union (EMU) when the currencies of the participating countries will be irrevocably fixed. In Stage Three, the single monetary policy will be conducted by the European System of Central Banks (ESCB). In this respect, the optimum currency area literature distinguishes several criteria for gauging the suitability of countries for joining in monetary unions. This strand of theory emphasises the point that a common currency area is more efficient the more correlated the underlying shocks hitting the national economies, since the more correlated the disturbances the smaller the need for independent macroeconomic policies. In fact, this comes down to examining the relative importance of

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[2]) As part of a bilateral agreement between Germany and the Netherlands, the current fluctuation margin of their respective currencies is 2.25 percent, whereas the formal fluctuation band of other participating currencies in the ERM is 15 percent.

country-specific and ERM-wide economic disturbances for national economic variables (Bayoumi and Eichengreen (1994), Kenen (1969), Tavlas (1994)).

Against these backgrounds, Austria's recent entry into the EMS and the ERM gives reason for exploring empirically to what extent Austria is integrated in Europe from a monetary perspective[3]). In this paper we shall address this question within an extended version of the original P*-framework[4]),[5]). More specifically, we shall investigate whether inflation behaviour in Austria is dominated by domestic or ERM-wide monetary factors. This analysis could provide insights into possible monetary spill-over effects from original ERM-members, which in turn may be relevant for a subject that has been at the forefront of recent discussions in Europe. It concerns the selection of an effective monetary strategy in Stage Three of EMU. Although several options are still open, it is possible that national central banks will ultimately settle for the use of intermediate monetary targets for the implementation and execution of the future single monetary policy. This offers an additional reason to investigate the links between Austrian prices and monetary developments on a European scale. In the absence of such a link, the situation in which a European monetary supply starts to function as an information variable in Stage Two of EMU may be less desirable from Austria's point of view.

The paper proceeds as follows. In section 2 we briefly sketch the conventional P*-concept. Section 3 describes our extended P*-framework that is capable of coping with the considerations mentioned above. In section 4 we take a look at the key variables in the P*-model for Austria. Here, we also succinctly pay attention to comparable variables in Belgium and the Netherlands. Section 5 contains the empirical results. The final section summarizes the main findings.

2. The original P*-model for a closed economy

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[3]) Gnan (1994) sketches the evolution and success of Austria's 'hard currency approach'. Furthermore, he elaborates on the practical and empirical links between this strategy, the optimum currency area literature and the current process of European monetary integration.

[4]) The original P*-model has been developed by Hallman, Porter and Small (henceforth HPS, 1989, 1991).

[5]) In connection with recent debates on monetary integration in Europe and the move towards EMU, we feel that the approach followed by Tatom (1992) and Kool and Tatom (1994) is less appropriate in the current situation. They have concentrated exclusively on the German influence on Austrian prices. However, this strategy ignores the possibility that nominal developments in other ERM countries may also have implications for the dynamics of inflation in Austria due to the increased degree of inflation and interest convergence in Europe in the past decade. A corollary of this opinion is that Europe-wide monetary conditions may well exert a significant impact on German prices, too.

The basis of the initial P*-model is Fisher's well-known equation of exchange identity:

$$P_i^d = M_i^d V_i^d / Y_i^d \quad \textbf{(1)}$$

where P, M, V and Y are the GDP deflator, the money stock, the velocity of M and real GDP, respectively. The superscript d indicates that the traditional P* model is formulated in terms of domestic variables. The subscript i refers to country i [6]).

The original proponents of the P*-framework, Hallmann, Porter and Small (henceforth HPS; 1989, 1991), hypothesize that an equilibrium version of equation (1) can be formulated:

$$P_i^{d*} = M_i^d (V_i^{d*} / Y_i^{d*}) \quad \textbf{(2)}$$

Here an asterisk denotes the long-run level, i.e. Y* represents potential real output, and V* is the equilibrium velocity of money. P* is the price level that, given the actual money stock, would prevail if both V and Y are at their equilibrium levels. The key assumption of the P*-model is that the actual price level will converge to the equilibrium price level in the long run. This implies that deviations between P^d and P^{d*} are only temporary.

To derive an expression for the gap between the long-run equilibrium price level and the actual price level, equation (1) is divided by (2) and the result is expressed in logarithms:

$$GAP_i^d = (p_i^d - p_i^{d*}) = (y_i^{d*} - y_i^d) + (v_i^d - v_i^{d*}) \quad \textbf{(3)}$$

where lower case symbols denote logarithmic levels. The domestic price gap (p^d - p^{d*}) is assumed to give an indication of future price developments. In the P*-model, the dynamics of the equilibrating mechanism are generally described by a constrained version of an "error-correction model" like equation (4):

$$\pi = a_0 + a_1 GAP_{t-1}^d + \sum_{j=1}^{n} \beta_j \pi_{t-j} + \in_t \quad \textbf{(4)}$$

where π is defined as (p_t - p_{t-1}). The theory predicts that a negative (positive) price gap will cause a temporary rise (fall) in the rate of inflation. Such an acceleration (deceleration) will in turn restore the equilibrium between p and p* over time. From expressions (3) and (4) it is also evident that inflationary pressures can come either from overutilization of existing capacities ($y^d > y^{d*}$) or from higher-than-usual money holdings ($v^d < v^{d*}$).

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6) For convenience, time subscripts are omitted.

When actual inflation is nonstationary, econometric problems could arise by estimating equation (4). If this is the case, HPS (1991) demonstrate that the following reparameterization of expression (4) can be estimated:

$$\Delta\pi = a_0 + a_1 GAP^{d}_{t-1} + \sum_{j=1}^{n} \delta_j \Delta\pi_{t-j} + +\delta_0 \pi_{t-1} + \in_t \quad \textbf{(5)}$$

3. The extended P*-model

It is quite likely that the increasing degree of economic integration witnessed in the past decades has rendered national variables to a relatively larger extent subject to international rather than purely domestic factors. This could be particularly true for national price developments. In this respect, the high degree of liberalisation and deregulation of capital flows, reflected in the remarkable rise of so-called currency substitution, has created a situation in which monetary conditions abroad can have direct implications for the development of domestic prices (McKinnon, 1982). If this is the case, the validity of the closed economy version of the P*-model discussed in the previous section has diminished in the course of time. In a sense, the views underlying the traditional P*-model also contrast with the (theoretical) notion that in small open countries with an exchange rate target, money supply becomes fully endogenous under certain conditions[7]).

To cope with these considerations, the traditional P*-model is extended to a similar monetary framework that is empirically applicable in a situation where monetary interdependencies between several ERM countries exist. Just as in Groeneveld *et al.* (1995) it is assumed that European equivalents of expressions (1) and (2) can be formulated:

$$P_{eur} = M_{eur}(V_{eur} / Y_{eur}) \quad \textbf{(6)}$$

$$P^{*}_{eur} = M_{eur}(V^{*}_{eur} / Y^{*}_{eur}) \quad \textbf{(7)}$$

Theoretically, the European money supply does not only determine the equilibrium European price level (P_{eur}*), but also pins down the equilibrium price level in each of the ERM countries through the exchange rate constraint, or in symbols:

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7) There is no monetary autonomy left to non-anchor countries in the ERM when the following conditions are simultaneously satisfied: the country does not exert a significant influence on the level of international interest rates; there is perfect international capital mobility; and there is perfect substitutability between domestic and foreign assets (see Roubini (1988) and Goodhart and Viñals (1994)).

$$P_i^{d'*} = E_i P_{eur}^{*} / ER_i^{*} \quad \textbf{(8)}$$

where $P^{d'*}$ is the new equilibrium domestic price level, E denotes the nominal exchange rate, equal to the number of domestic currency units per unit of foreign currency in which the European aggregates are expressed and ER* stands for the equilibrium real exchange rate.

Our extended model has important theoretical implications for the short-run price dynamics in each country. Firstly, p^{d*} in equation (3) must be replaced by $p^{d'*}$ as defined in expression (8), yielding a European or foreign price gap (GAP^{f1}).

$$GAP_i^{fl} = \left(p_i^d - p_i^{d'*}\right) = \left[p_i^d - \left(p_{eur}^{*} + e_i - er_i^{*}\right)\right] \textbf{(9)}$$

The foreign price gap is now expected to influence the future path of inflation in each country. When the domestic price level exceeds the European equilibrium price level (adjusted for changes in nominal and equilibrium real exchange rates), we hypothesize that downward pressure on domestic inflation results. The amount of pressure that this gap actually exerts on inflation in the core countries and the speed of adjustment toward equilibrium depend on the extent of arbitrage in goods and capital markets, and the degree to which the economies are integrated [Kool and Tatom (1994)].

The second implication of the extended model is that the effect of the domestic price gap on domestic inflation developments is expected to decrease with greater economic and financial integration in Europe. Since the degree of integration in Europe has presumably increased over time (possibly due to the establishment of the EMS), it seems recommendable to examine the relative impact of purely domestic and European price gaps on domestic inflation over time.

Both theoretical considerations are tested in Section 5. In a first test, we simply replace the domestic gap by the foreign gap. In a second test, we insert both gaps simultaneously in the inflation equation, or formally:

$$\Delta\pi = a_0 + a_1 GAP_{t-1}^{d} + a_2 GAP_{t-1}^{f2} + \sum_{j=1}^{n} \delta j \Delta\pi_{t-j} + + \delta_0 \pi_{t-1} + \in t \ \textbf{(10)}$$

It should be pointed out that there is a subtle, yet important difference between GAP^{f2} and GAP^{f1} from equation (9). The European variables used to construct GAP^{f2}do not comprise national data for the country in question. In this way, the estimations are less affected by multicollinearity problems due to the existence of correlation between GAP^{d} and GAP^{f1}

(which also includes national data of country i). Moreover, this test enables us to explore whether the impact of a European money supply on domestic inflation rates is separate from, and more powerful than, that of the countries' own national monetary aggregates.

Important elements in constructing the European price gaps concern the computation of European variables and the calculation of the equilibrium variables. In this paper the national data on the money stock and real and nominal income are aggregated with current exchange rates against the German mark[8]). The long-run variables are generated with the so-called Multi State Kalman Filter developed and programmed by Kool (1989).

4. A preliminary look at the data and the price gaps for Austria

In this section the relevant variables within the P*-framework for Austria are compared with those for two other relatively small European countries, namely Belgium and the Netherlands. Monetary policies in the latter countries have also been primarily focused on trying to stabilise the national currency against the German mark in the past decades[9]). The decision to peg their currencies to the mark is predominantly motivated by Germany's outstanding inflation record coupled with the fact that it is their largest trading partner. By locking their currencies to the D-mark, these countries in fact import Germany's low inflation.

Chart 1 provides an indication of the degree of success of each country in stabilising its nominal exchange rate vis-à-vis the D-mark, with the 1970 exchange rate indexed to 100. As is apparent from this figure, the schilling depreciated slightly in the 1970s, but returned to its 1970 level in the early 1980s. The strengthening of the schilling towards the end of the 1970s was set in motion by the adoption and subsequent public acceptance of the so-called hard currency strategy of the Austrian monetary authorities [Hochreiter and Winckler (1995)]. This policy concept was put into practice by revaluing the schilling against the German mark by 1.5 percent in September 1979. The rationale for this policy step was to dampen wage increases which could ensue from the second oil price hike in 1979. Since then credibility has risen considerably and helped to maintain a very close link between the schilling and the German mark.

Up to the beginning of the 1980s the guilder gradually lost some ground vis-à-vis the German mark, whereas the Belgian franc experienced a considerable depreciation until the mid-1980s.

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8) It is recognised that the existing methods to convert quantity variables into a common currency are all fraught with (conceptual) drawbacks (see Annex IV, IMF World Economic Outlook (1992)).

9) However, it must be stressed that Belgium did not publicly declare until 1990 its goal of a very narrow range of fluctuation of its currency against the German mark (Eizenga (1994)).

All in all the guilder and Belgian franc have depreciated by about 14 and 53 percent respectively since 1970. As Chart 1 illustrates, the depreciation of the latter nominal exchange rates largely took place before 1985, when the ERM started to 'harden'[10]). The temporary fall and subsequent recovery of the Belgian franc in the 1990s obviously reflect the turbulence in the ERM around 1992. These movements also suggest that the Belgian monetary authorities took appropriate steps to restore confidence.

Chart 2 shows that real exchange rate movements have on balance been much smaller. The virtually constant value of the schilling combined with the fact that Austrian inflation has exceeded German inflation to some extent has led to a real appreciation of the Austrian currency of nearly 20 percent since 1970. On the other hand, the guilder and the Belgian franc have undergone a real depreciation of approximately 4 and 15 percent, respectively.

Table 1 presents the average real growth, inflation and monetary expansion in several subperiods. Here, as in the remainder of this paper, inflation is measured as the quarterly change in the GDP deflator, while money growth represents the quarterly change in broad money M3. All the data are seasonally adjusted.

Table 1: Average inflation, economic growth and monetary expansion

	Inflation			**Economic growth**			**Growth of M3**		
Sample	**AUS**	**BEL**	**NET**	**AUS**	**BEL**	**NET**	**AUS**	**BEL**	**NET**
73.1-94.4	1.1	1.3	1.0	0.6	0.5	0.6	2.1	2.1	2.0
73.1-78.4	1.6	2.1	1.9	0.6	0.6	0.8	3.0	2.9	2.8
79.1-94.4	1.0	1.0	0.6	0.6	0.4	0.5	1.8	1.8	1.6
79.1-85.4	1.2	1.3	0.9	0.5	0.2	0.3	2.1	1.5	1.6
86.1-94.4	0.8	0.8	0.3	0.6	0.6	0.6	1.5	2.1	1.7

In the full sample, inflation was highest in Belgium, followed by Austria and the Netherlands. Interestingly, this picture remains almost the same in different subperiods. Moreover, inflation reached its highest level in the 1970s and its lowest value in the period 1986.I-1994.IV in every country. Concerning real economic growth, Austria and the Netherlands experienced a

[10]) See Artis and Taylor (1994), Edison and Kole (1994), Giavazzi and Giovannini (1989) and Ungerer et al. (1986) for empirical analysis of the effect of the ERM on the behaviour of exchange rates.

quarterly growth rate of about 0.6% in the entire time span. On the other hand, economic growth in Belgium was somewhat lower. However, this is not the case in different subsamples. In the first subperiod, the Austrian and Belgian economies expanded by 0.6 percent, whereas economic growth in the Netherlands amounted to 0.8 percent. Since 1979 this situation has been reversed. In this subperiod the Austrian economy exhibited the largest growth, due to its relatively favourable performance in the early 1980s. Taken together, the real appreciation of the schilling does not seem to have influenced the overall economic performance in Austria in a negative way. Finally, in every period considered, the average increase of the money stock lies in the same order of magnitude. The strongest monetary expansion took place in the 1970s, when prices were rising quite rapidly, too. Thereafter, the growth of the money supply gradually slowed down. In the last subsample, monetary expansion in the three countries varied between 1.5 and 2.1 percent.

The next step in our empirical research is the examination of the time series properties of the key variables in the conventional and extended P*-framework. To this end we have performed standard augmented Dickey-Fuller (ADF) tests to determine the order of integration by following the procedure proposed by Dickey and Pantula (1987)[11]). The ADF results suggest that the price level (p) generally contains two unit roots, indicating that equation (5) is the most appropriate specification. Conversely, real output (y) and the velocity of money (v) appear to have just one unit root. This implies that their equilibrium counterparts (y* and v*) cannot simply be proxied by means of a regression with a deterministic time trend. Indeed, measures of y* and v* constructed in this way are not useful because the resulting p* measure is likely to yield a nonstationary price gap which would violate the main assumption of the P*-model that deviations between p and p* are only transitory[12]).

To overcome this econometric problem, existing P*-studies have used other ways to compute these equilibrium variables. For instance, Hoeller and Poret (1991) have employed the Hodrick-Prescott filter to determine equilibrium time paths for output and velocity. In this paper, the long-term variables are constructed with the so-called Multi State Kalman Filter technique[13]).

Chart 3 gives an impression of the development of the domestic and European price gap for Austria over time. It should be noted that the European price gap is calculated according to equation (9). Apart from the Austrian data, the European variables used to calculate this gap

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11) The results of these tests are not reported here, but are available upon request from the author.

12) In this respect, Tatom (1992) has in fact incorrectly used a linear trend model of the level of velocity in testing the traditional P*-model for Austria.

13) For a thorough discussion of the underpinnings and algebraic features of this method the reader is referred to Harvey (1991) and Kool (1989).

comprise national data for four initial ERM countries, i.e. Belgium, France, Germany and the Netherlands. To start with, Chart 3 illustrates that both gaps tend to move around zero, suggesting that both variables are stationary. Formal econometric tests indeed confirm this visual conclusion. Secondly, the graph reveals that the pattern of purely national distortions generally differs from that of economic imbalances on a European scale[14]).

The largest economic distortions are concentrated in the first part of the sample. This may stem predominantly from shocks originating from the supply side of the economy, notably the first oil crisis. During this period, however, the swings in the European price gap are even more pronounced. This is to some extent caused by fairly strong fluctuations in nominal exchange rates at that time. Thereafter, the magnitude of both domestic and European price gaps decline in absolute terms.

The mostly divergent development of domestic and European price gaps logically raises the question which variable is the most appropriate indicator for potential inflationary threats in Austria. In the next section we shall address this issue by investigating the information content of purely domestic and European monetary conditions on the dynamics of inflation in Austria. Here we shall also take into account - by considering different estimation periods - the possibility that the relative importance of both gaps may have altered over time due to the - ongoing - process of monetary integration witnessed in the past decades.

5. The impact of national and European monetary factors on Austrian prices

To assess the empirical applicability of the conventional and extended P*-concept for Austria, we have used a fairly simple equation to model short-run inflation dynamics. As a starting point we have estimated expression (5) with four lagged dependent variables. Subsequently, we have dropped those terms that were insignificant at the 10 percent level. Initially, energy prices were also included in the statistical analysis because their influence is often a matter of concern (Kole and Leahy (1991), Reimers and Tödter (1994)). However, we never found a significant direct impact of energy prices on Austrian inflation so we removed this variable from our estimation equation. In the following section we will first discuss the results with the domestic price gaps. Subsequently, we pay attention to the results with European price gaps. Our estimations are subject to a battery of diagnostic tests of which the main results are also recorded in table 2.

The results with domestic price gaps are presented in the upper part of table 2. As can be inferred from the estimations, the traditional P*-model is accepted for the entire time span.

[14]) For the other ERM-countries, one can generally observe the same feature.

Here, we find that a positive price gap of 1 percent leads to a fall in the inflation rate of about 0.16 percentage points. Surprisingly, this finding contrasts with earlier studies on the validity of this framework for Austria (see Hoeller and Poret (1991), Tatom (1992), Kool and Tatom (1994)). The latter studies reject a significant link between domestic price gaps and national price developments. Plausible explanations for our opposite conclusion are the use of a different method to generate the equilibrium variables, a different sample period and another frequency of the data. Our regression also implies that there is a significant pass-through from domestic money growth to inflation over the full sample. However, no policy implications can be extracted from this outcome. The reason is that Austrian monetary authorities have actually never attempted to steer or control inflation by relying on monetary targeting as an intermediate strategy. Hence, Austria has never pursued a monetary policy aimed at hitting monetary targets as has been the case in Germany since the mid-1970s.

In the time interval covering the entire EMS-period, the impact and significance of the domestic price gap decrease to some extent. Since 1986 the domestic price gap has, however, completely lost informative value for predicting price trends in Austria. This deteriorated suitability as an accurate indicator illustrates the blurring link between domestic monetary aggregates and national inflation rates when countries give priority to the exchange rate objective.

In the second part of table 2 the results with the European price gap (GAP^{f1}) are shown. Over the full sample, Austrian prices do not react to economic distortions on a European scale. This picture changes in the second time interval. Now European price gaps significantly translate into price developments at the five percent level. In the last subperiod the negative impact of the European price gaps on the inflation rate rises further from -.15 to -.22, while the significance level of the gap coefficient remains the same. These results are in fact the mirror-image of those with domestic price gaps. The estimations suggest that nowadays Europe-wide monetary conditions are more relevant for the future path of inflation in Austria. The increased importance of monetary spill-over effects from other European countries is presumably caused by the European oriented focus of Austria. In this respect, its monetary philosophy as well as drastic changes in the international institutional environment, e.g. the liberalisation of capital flows and deregulation in the 1980s, have apparently accounted for the early monetary anchoring of Austria in Europe.

When the domestic and European gaps enter the inflation equation simultaneously, one can again observe the shift in relative importance from domestic to European price gaps with the passage of time (see the lower part of table 2). Hence, these results are in line with those where both variables are included separately. Over the full sample, both gap coefficients carry the expected negative sign, but only the national gap measure significantly affects the rate of inflation. In the entire EMS-period the predictive power of the European price gap (GAP^{f2})

improves at the cost of the domestic gap. This process continues in the last sub-period. As can be inferred from the table, the results pertaining to the third time interval indicate that the domestic gap even provides misleading information for price developments to come; the gap coefficient has turned positive. Conversely, the European price gap now proves to be a reliable warning signal for potential inflationary risks in Austria.

As a rough check of the usefulness of domestic and European gaps, we have performed out-of-sample forecasts. To this end, we have re-run the equations for the period 1986-1992 and subsequently used the estimated parameters to generate predictions for inflation in the period 1993-94. The statistical output of this exercise is documented in table 3.

Table 3: The forecast performance of the equations with domestic and/or European price gaps over the period 1993-94

	Equation with:		
	GAP^{d}	**GAP^{f1}**	**GAP^{d} and GAP^{f2}**
Root mean squared error[1]	.56	.50	.52
Mean absolute error[1]	.51	.43	.46
Mean absolute percentage error	98.5	88.3	93.3
Theil inequality coefficient	.37	.32	.32

[1] Multiplied by 100.

The forecast evaluation confirms that the insertion of a European price gap produces the best inflation predictions. Without exception the test statistics have more favourable properties in the case of the European gap embodying the overall monetary situation in the group.

6. Concluding remarks

Domestic money growth significantly contributes to the explanation of Austrian inflation in the period 1973-1994. Since the late 1970s onwards, this has no longer been the case. Nowadays the (equilibrium) price level in Austria is largely determined by ERM-wide monetary circumstances. Thus, an excessive monetary expansion in other European countries seriously endangers price stability in Austria. Viewed in this light, targeting a European money stock in the present Stage Two of EMU seems recommendable from Austria's perspective. Interestingly, these findings accord with those for Belgium and the Netherlands, which have participated in the EMS and ERM from the outset (Groeneveld *et al*. (1995)).

Hence, the Austrian example teaches us that participation in formal exchange rate agreements is not necessarily required to build a good inflation reputation and to establish firm monetary ties with other (ERM) countries. What actually seems to matter is the commitment to follow a single-minded and transparent monetary policy, which must be supported by a broad social and political consensus and a cooperative approach in wage and price policies.

Table 2: Regression results with domestic and/or European price gaps (based on M3 and calculated with current nominal exchange rates)

Sample	Domestic price gap	European price gap	LDV	R_2	SE	Q(8)	HET
73.1-94.4	-.160 (2.4")		12	.59	.89	8.1	12.8'
79.1-94.4	-.124 (1.6°)		12	.64	.79	4.6	9.1
86.1-94.4	-.047 (0.5)		12	.44	.65	4.4	13.7'
73.1.-94.4		-.109 (1.4)	12	.58	.89	9.3	12.8'
79.1.-94.4		-.149 (2.0')	12	.65	.79	6.4	12.7'
86.1.-94.4		-.219 (2.0')	12	.5.0	.62	11.0	10.7°
73.1.-94.4	-.128 (1.9°)	-.063 (0.8)	12	.59	.89	7.5	13.4°
79.1.-94.4	-.086 (1.0)	-.104 (1.3)	12	.65	.79	5.0	12.7°
86.1-94.4	-.017 (0.2)	-.219 (1.9°)	12	.48	.63	12.0	14.7'

Note: The price gaps are included with a lag of three quarters in all cases. Heteroskedasticity-consistent t-statistics are recorded behind the estimated coefficients. LDV denotes the significant lags of the dependent variable. 12 means that the first and second lag of the change in the inflation rate are significant and included. SE is the Standard Error of the regression multiplied by 100. Q(8) is the Box-Pierce statistic for serial correlation in the residuals. HET is White's statistic for heteroskedasticity and is distributed as χ^2. The symbols °, ' and " denote that the test statistic differs significantly from zero at the ten, five and one per cent level, respectively.

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