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Real exchange-rate changes in the European Community: The empirical evidence and its implications for European currency unification

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Kiel Working Papers

Working Paper No. 39

REAL EXCHANGE-RATE CHANGES
IN THE EUROPEAN COMMUNITY

The Empirical Evidence and its Implications for
European Currency Unification

by

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I. Real Exchange-Rate Changes and Currency Unification

Is the European Community (EC) (already) a desirable currency area¹? There are two kinds of reasons why it may not.

The first reason is that national propensities to inflate may be too different within the EC to permit the abandonment of exchange-rate changes². Nominal exchange-rate changes are required to make differences in national monetary policies possible as well as to compensate for the resulting differences in the prices of tradable goods and services. The argument is political rather than economic in nature; what is in doubt is essentially the political will of member governments to agree on a common rate of inflation and not so much the economic feasibility of such a procedure. - However, there are also economists who have argued that harmonisation of national inflation rates is likely to produce economic losses, i.e. needless unemployment in some member countries and needless inflation in others³. The assumption that is common to them is that there is a long-run trade-off between inflation and unemployment and that this trade-off (the so-called Phillips curve) is different in different member countries. The validity of these Keynesian assumptions is disputed by modern monetarist theory and refuted by the experience of inflation in this decade: as money illusion is eroded in the process of inflation, the trade-off disappears. Governments, it is true, may still be under the "Phillips illusion". But this is not to say that inflation-rate differentials in the Community are an economic rather than a political obstacle to currency unification.

The second objection to EC currency unification is purely economic. It concerns real, not nominal, exchange-rate changes. Even if inflation rates within all member countries are more or less the same - the argument runs -, exchange rates between their currencies will have to change if the terms of trade or currency preferences change. The terms of trade will tend to change when (physical) productivity increases at different rates in the export industries of different member countries⁴ or if demand shifts between the exports of different member countries for reasons other than price changes. Currency preferences will shift notably in reaction to changes in risk which may either affect expected yields or the variance of the probability distribution of asset yields

around their expected value or the covariance with the yields of all other assets. Since risk evaluation of the latter type depends on the composition of the specific portfolio that is to be diversified, a mere change in the distribution of existing wealth (say, as a consequence of OPEC) will suffice to alter aggregate currency preferences.

Of course, the terms of trade and currency preferences also affect each other. For example, if risk decreases in country A in relation to other countries and currency preferences shift in favour of A, the currency of A will appreciate and its terms of trade will tend to improve.

Alternatively, if A prevents the appreciation of its currency by increasing its (money) supply and reducing interest rates to compensate for the reduction in risk, (additional) inflation in A will result, the prices of A's exports will increase and its terms of trade improve as in the flexible exchange-rate case. In both cases the improvement in A's capital account will be matched by a deterioration in the trade balance and in both cases A's real rate of exchange will appreciate.

If real exchange-rate changes occur irrespective of whether nominal exchange-rates are flexible or fixed, how can the need of real exchange-rate changes provide the basis for an objection to EC currency unification at this stage? As the preceding example has shown, flexibility of nominal exchange rates has the advantage that it permits changes in real exchange rates to occur without affecting domestic price-level stability within the countries concerned. Country A can have its improvement in the terms of trade without an increase in the domestic price level, and the other countries which suffer a deterioration in the terms of trade may do so without a reduction of the domestic price level and the additional unemployment that tends to go with it in the short run when downward flexibility of prices and wages is insufficient.

Another advantage of nominal exchange-rate flexibility is that nominal exchange-rate changes will facilitate real exchange-rate changes provided exchange-rate illusion has not yet been eroded completely. If, for example, productivity increases faster in the central areas of the Community than in the peripheral areas, but trade unions insist on equal increases of nominal wages in both types of areas, fixity of

nominal exchange rates will lead to unemployment in the peripheral regions, for producers there will either face a reduction in profit margins or, if they try to shift the increase in wages to prices a reduction in the demand for their products. In this situation, the restoration of full employment requires a reduction of real wages or subsidies to producers in the peripheral areas. If trade unions do not allow - or do not allow fully - for the rise in import prices (the deterioration of the terms of trade) which currency depreciation would produce nominal exchange-rate adjustment may be an effective means in bringing about a real exchange-rate depreciation and hence a reduction in real wages. However, unemployment is merely replaced by (a widening of) regional wage differentials; thus real exchange-rate changes are not - at least not in the longer term - a substitute for factor movements.

Given that the need for real exchange-rate changes is the only important economic criterion in judging whether a group of regions constitutes a desirable currency area, it seems surprising that no attempt has been made so far to measure real exchange-rate changes in the European Community as a whole and to compare them with the real exchange-rate changes between the regions or cities of existing currency areas that are generally considered desirable. In this paper, real exchange-rate changes from 1959 to 1974 will be calculated and compared for the European Community of the Nine and W.Germany on a quarterly, an annual and a **four** year basis. Subsequently, the results will be compared with the corresponding data for two currency areas the desirability of which seems dubitable to some economists: Italy and the United States.

II. The Measurement and Comparison of Inter- and Intra-Country Real Exchange-Rate Changes

Real exchange-rate changes within a unified currency area are equivalent to interregional differences in the rates of inflation. By which index

is inflation to be measured? The purchasing-power parity doctrine is usually formulated with regard to the prices of tradables, and Ronald McKinnon has argued that for these the wholesale price index is the best proxy⁵. The objective of domestic price-level stability, on the other hand, is usually defined in terms of consumer prices. The question at issue in this study is whether fixity of intra-Community exchange-rates or currency union would imply intolerably high divergences of the national rates of change of the domestic price level from (zero if the average Community price level were stable. Thus the consumer price index has to be used. Real exchange-rate changes so defined will, of course, reflect not only changes in terms of trade and in currency preferences but also the systematic differences in the discrepancy between consumer and tradables prices among the regions and countries in question⁶.

Within a currency area, (unweighted) real exchange-rate changes R_w may be measured as the variance of regional inflation rates around their common mean:

$$R_w = \text{Var}\left(\frac{d \log \overline{\text{CPI}}_i}{dt}\right) = \frac{\sum (p_i - \bar{p})^2}{n-1}$$

where p_i = the rate of inflation in region i as measured by % changes in the period average of the consumer price index ($\overline{\text{CPI}}_i$)

\bar{p} = the average rate of inflation in all regions considered,
and

n = the number of regions considered.

Between different currency areas, allowance has to be made for both differences in inflation rates and changes in exchange rates. For this reason, the rates of increase, of which we wish to know the variance, refer to the product of the consumer price index and the prevailing exchange rate vis-a-vis some common numeraire (e):

$$R_b = \text{Var}\left(\frac{d \log (\overline{\text{CPI}}_i \cdot \bar{e}_i)}{dt}\right) = \frac{\sum (\pi_i - \bar{\pi})^2}{n-1}$$

where \bar{e}_i is the average number of units of the numeraire currency (q_n) required to obtain one unit of currency i (q_i) during the period under consideration.

Since the consumer price index CPI_i indicates the number of units of currency i (q_i) required to purchase a given basket of consumer goods (g_i), it is evident that

$$CPI_i \cdot e_i = \frac{q_i}{g_i} \cdot \frac{q_n}{q_i} = \frac{q_n}{g_i}$$

Thus $\pi = \frac{d \log(CPI_i \cdot e_i)}{dt}$ measures the rate at which the amount of numeraire currency n required to obtain a given basket of goods in country i increases (or falls) over time. For reasons of convenience, a third currency, the US dollar, was used as the numeraire, but, of course, any currency would have done provided that cross rates were consistent. This is because R_b is not affected by exchange-rate changes vis-a-vis the numeraire that are common to all Community currencies. What matters are merely the differences between the changes to which the purchasing power of the US dollar was subject in the various Community countries, for these differences are identical with real exchange-rate changes between the Community currencies.

If it is assumed that the populations of p_i and π_i are normally distributed around their means, the hypothesis that their variances are equal (i.e. that unweighted real exchange-rate changes are as large within currency areas as between them) can be tested by calculating the F-ratio (R_b/R_w) of the sample variances (i.e. of the variances of measured p_i and π_i). Note that this F-test of two sample variances from two different populations must not be confounded with the conventional analysis of variance technique which, for example, Hans Genberg has used to test the validity of the international monetarist theory of inflation under fixed exchange rates for the OECD countries⁷. While our F-statistic compares two variances of inflation rates over space (between countries and regions, respectively), Genberg has compared the (spatial) variance of average country inflation rates around the world mean with the sum of the (temporal) variances of individual countries' inflation rates around their means. However, the variance of individual countries' inflation rates over time is hardly a meaningful measure-rod in determining whether inflation rates have been significantly different in different

countries at any given point in time. To group periods (quarters) according to the world average rate of inflation (as Genberg does) does not solve this problem but rather introduces an additional arbitrary element (infact it turns out that it leads to varied results). Nor is the defect eliminated by applying the same conventional analysis of variance test to the variation in the rate of price change between the areas within a single country (the United States) and by comparing the inter-country (OECD) and the inter-regional (US) F-ratio⁸: the temporal variation is still incorporated in the denominators of the two F-ratios and there is no reason to assume that they will cancel out.

Another important difference between this and Genberg's study is that Genberg does not allow for changes in exchange rates between the OECD currencies except by deleting all quarters in which such exchange-rate changes had taken place. As the author himself realises he is thus making the extremely heroic assumption that "the adjustment to the exchange-rate change was complete within the quarter. Exchange-rate changes were in other words treated as breaks in the price index series affecting only the quarter of the parity change"⁹.

As our analysis takes full account of exchange-rate adjustments, it may be doubted whether quarter-to-quarter rates of p_i and π_i cover the most relevant time span. After all, econometric studies indicate that exchange-rate changes have their maximum impact on the balance of **trade** after about three years¹⁰. For this reason, the calculation has been executed on a quarterly, an annual and a four-year basis, i.e. quarterly, annual and four-year averages of consumer price indices and exchange rates were used in computing p_i and π_i . Exchange-rate averages were taken from the Federal Reserve Bulletin¹¹, consumer price averages from the 1972 and 1973 Supplements to "International Financial Statistics" (IMF), respectively, and successive monthly issues of the main series. For the period 1959 - 1974, regional consumer price indices exist only for four W.German Laender: Nordrhein-Westfalen, Baden-Wuerttemberg, Saarland und W.Berlin¹². Fortunately, however, the variance of this sample is likely to be highly representative of the Federal Republic; for it contains an equal number of central (Nordrhein-Westfalen and Baden-Wuerttemberg) and peripheral (Saar-

land and W.Berlin) economic regions and an equal number of mainly urbanized (Nordrhein-Westfalen and W.Berlin) and more rural (Baden-Wuerttemberg and Saarland) areas.

The results of the quarterly calculations are shown in Table 1. The most striking feature is probably the extremely high variability of the F-ratio ($= R_{EC}/R_{WG}$) which ranges from 40 in 1966 I to 2190.73 in 1973 III. Inspection of the data shows that the high variations of F are mostly due to exchange-rate changes such as the revaluations of the DMark in March 1961, Sept./Oct. 1969, the second half of 1971 and the first three quarters of 1973, the devaluations of Sterling in 1967 IV and during the second half of 1972 and the devaluations of the French Franc in 1969 III and in the second half of 1973. This corroborates the conjecture that a quarter is probably too short to allow for the interdependence of inflation-rate differentials and exchange-rate changes and that the F-ratios will therefore overstate the long-term variability of real exchange rates within the Community.

The results of Table 1 can be summarised as a frequency distribution indicating which F values are consistent with the hypothesis that real exchange-rate changes are not larger within the EC than within the Federal Republic at which level of significance (one-tailed test with 8 and 3 degrees of freedom):

$R_{EC} < R_{WG}$ or $F < 1$		4
$1 < F_{obs.} < F_{(05)}$	= 8.34	16
$F_{(.05)} < F_{obs.} < F_{(.025)}$	= 14.5	8
$F_{(.025)} < F_{obs.} < F_{(.01)}$	= 27.49	8
$F_{(.01)} < F_{obs.} < F_{(.005)}$	= 44.1	2
$F_{(.005)} < F_{obs.}$		22
		<u>$\Sigma = 60$</u>

As can be seen, the hypothesis that $R_{EC} > R_{WG}$ must be rejected for most quarters with a probability of 97.5 % (but not with a probability of 99 %).

The grouping of quarters by their F-values is inferior to a pooling

TABLE 1 - Quarterly Real Exchange-Rate Changes in the
European Community and W.Germany

t	R _{EC}	R _{WG}	F _{EC, WG}	t	R _{EC}	R _{WG}	F _{EC, WG}
60 I	.498	.050	9.96	67 III	7.600	.013	584.62
II	.832	.088	9.46	IV	7.285	.048	151.78
III	.299	.448	.67	I	9.578	.155	61.79
IV	.417	.074	5.64	II	1.006	.017	59.18
61 I	1.042	.316	3.30	III	.219	.263	.85
II	4.570	.064	71.40	IV	.436	.044	9.91
III	.951	.205	4.64	I	1.892	.081	23.36
IV	.901	.052	17.33	II	.302	.133	2.27
62 I	.612	.066	9.27	III	3.726	.033	112.91
II	1.480	.076	19.47	IV	9.095	.008	1136.88
III	.966	.148	6.53	I	.586	.030	19.53
IV	2.460	.017	144.71	II	.858	.017	50.47
63 I	1.094	.149	7.34	III	7.913	.044	179.84
II	.695	.065	10.69	IV	6.089	.080	76.11
III	1.372	.021	65.33	I	1.043	.263	3.97
IV	1.864	.045	41.42	II	1.064	.033	32.24
64 I	.479	.063	7.60	III	1.204	.116	10.38
II	2.359	.119	19.82	IV	3.299	.018	183.28
III	.648	.088	7.36	I	1.661	.154	10.79
IV	.235	.030	7.83	II	.355	.069	5.14
65 I	.086	.111	.78	III	6.450	.323	19.97
II	.436	.038	11.47	IV	2.299	.013	176.85
III	.666	.076	8.76	I	3.093	.034	90.97
IV	.224	.117	1.92	II	9.603	.078	123.12
66 I	.431	1.083	.40	III	24.098	.011	2190.73
II	.423	.087	4.86	IV	2.821	.013	217.00
III	.249	.071	3.51	I	5.381	.315	17.08
IV	.335	.017	19.70	II	6.604	.033	200.12
67 I	.207	.044	4.70	III	6.957	.045	154.60
II	4.574	.025	182.96	IV	2.974	.010	297.40

(averaging) of quarterly variances and the calculation of a common F-ratio for the pooled R_{EC} and R_{WG} . This is because the frequency distribution does not indicate whether the values range at the upper or the lower end of each category. The formula for pooling variances is

$$\bar{s}^2 = \frac{(n_1-1) s_1^2 + (n_2-1) s_2^2 + \dots + (n_k-1) s_k^2}{n_1 + n_2 + \dots + n_k - k}$$

Since n (the number of indices used) is identical for all (k) samples (quarters), the formula reduces to

$$\bar{s}^2 = \frac{(n-1) \sum_{i=1}^k s_i^2}{n \cdot k - k} = \frac{(n-1) \sum_{i=1}^k s_i^2}{k(n-1)} = \frac{\sum_{i=1}^k s_i^2}{k}$$

and since k (the number of quarters) is the same for both \bar{s}_{EC}^2 and \bar{s}_{WG}^2 , the F-statistic is simply $\sum_{i=1}^k s_{EC}^2 / \sum_{i=1}^k s_{WG}^2$ (or $\sum_{i=1}^t R_{EC} / \sum_{i=1}^t R_{WG}$ as in our previous connotation) with $k(n-1)$, i.e. 480 and 180 degrees of freedom, respectively. The observed F for the pooled variances turns out to be 26.30 which is far above the critical $F_{(.01)}$ of 1.33. Thus the quarterly data are inconsistent with the hypothesis that $R_{EC} \neq R_{WG}$ with a probability of much more than 99 %.

The same holds true for the pooled variances of the annual and the four-year data which are listed in Table 2¹³. Indeed, the F-value for the pooled annual variances is even higher (29.0) than the F-value for the pooled quarterly variances (26.30); only the pooled four-year variance (24.5) is less unfavourable for the hypothesis. The observed F's become a smaller multiple of their critical $F_{(.01)}$ (1.87 and 4.73, respectively) as the time span over which the CPI's and exchange rates are averaged increase, but for the pooled annual data this is only due to the fact that the critical F's become larger as the number of observations decreases.

It may be objected that the Federal Republik is economically unusually homogeneous and that it is unreasonable to evaluate the desirability of EC currency unification by this standard. To meet this objection, the variances of inflation rates were also calculated for 15 major US cities¹⁴ and the 20 Italian provincial capitals¹⁵ (however, only on

TABLE 2 - Annual and Four-Year Real Exchange-Rate Changes in the European Community and W.Germany

t	R _{EC}	R _{WG}	F _{EC, WG}	t	R _{EC}	R _{WG}	F _{EC, WG}
1960	1.521	.937	1.62				
1961	3.823	.202	18.93	1963-66	19.451	1.715	11.34
1962	3.704	.065	56.98	1967-70	29.311	1.630	17.98
1963	4.123	.030	137.43	1971-74	101.029	2.765	36.54
1964	1.811	.057	31.77				
1965	.995	.416	2.39	Pooled	49.930	2.037	24.51
1966	2.945	1.104	2.67				
1967	3.085	.160	19.28				
1968	24.514	.052	471.42				
1969	4.886	.271	18.03				
1970	11.513	.114	100.99				
1971	5.903	.259	22.79				
1972	6.887	.864	7.97				
1973	61.962	.125	495.70				
1974	9.676	.409	23.66				
Pooled	9.823	.338	29.06				

an annual basis). The indices used are the US consumer price index and the Italian cost-of-living index. While the American data cover the full period 1959-74, the Italian series starts in 1961. The annual results are shown in Table 3.

Comparisons of the observed and the critical F-values for the pooled variances indicate that with 99 % probability R_{EC} is also larger than R_I and R_{US} although R_I is in fact significantly larger than R_{WG} ¹⁶. With the same probability it can be stated that in most years (frequency distribution) $R_{EC} > R_I$ and $R_{EC} > R_{US}$.

TABLE 3 - Annual Real Exchange-Rate Changes in the EC,
the United States and Italy

t	R _{EC}	R _I	F _{EC,I}	R _{US}	F _{EC,US}	F _{EC,WG}
1960	1.521	-	-	.247	6.16	1.62
1961	3.823	-	-	.153	24.99	18.93
1962	3.704	1.114	3.32	.236	15.70	56.98
1963	4.123	1.135	3.63	.168	24.54	137.43
1964	1.811	.965	1.88	.201	9.01	31.77
1965	.995	.613	1.62	.169	5.89	2.39
1966	2.945	.465	6.33	.329	8.95	2.67
1967	3.085	.377	8.18	.153	20.16	19.28
1968	24.514	.226	108.47	.258	95.02	471.42
1969	4.886	.303	16.12	.272	17.96	18.03
1970	11.513	.483	24.60	.549	20.97	100.99
1971	5.903	.468	12.61	.910	6.49	22.79
1972	6.887	.538	12.80	.271	25.41	7.97
1973	61.962	2.785	22.25	.256	242.04	495.70
1974	9.676	.987	9.80	.612	15.81	23.66
Pooled	9.823	.805	12.20	.319	30.80	29.09

Critical F-Values at the 99 % Level

	Annual		Pooled	
	df	F(.01)	df	F(.01)
EC,I	8,19	3.63	120,247	1.45
EC,US	8,14	4.14	120,210	1.47
EC,WG	8,30	27.49	120,45	1.87

III. The Interpretation of Comparisons of Inter- and Intra-Country Real Exchange-Rate Changes - A Caveat

The results of Section II have to be interpreted with considerable caution. This is because there are systematic reasons for suspecting that the observed variance between countries (R_b) will differ from the observed variance between regions and cities within a country (R_w) even if there are no differences in the homogeneity of the economic structure and hence in the need for real exchange-rate adjustments:

1. As Table 4 demonstrates¹⁷, the weights accorded to the main classes of goods (food and tobacco, manufactures, rent and energy, services) in the national consumer^{price}/indices differ widely (probably more widely than is justified by differences in consumer habits) between the nine member countries, the difference between the maximum and the minimum weight exceeding twelve percentage points in all four instances, while the regional and city indices are based on the same consumer basket thus understating differences in consumer habits.
2. The variances that have been calculated in Section II are affected by differential changes in indirect taxes (even where these are levied according to the destination principle, i.e. not on exports by residents). They may even reflect differential changes in direct taxes. Both types of tax changes are far more likely to be common to the regions and cities of a country than to the sovereign member countries of the European Community.
3. Part of the variance may be due to a lack of market integration (transport costs, information costs, non-tariff barriers). Clearly, market integration is likely to be closer the smaller the area concerned and the fewer language and administrative barriers exist within it. Hence one should expect the variance to be larger for the EC as a whole than for one of its constituent members¹⁸.
4. Some prices such as postage, phone charges, insurance premia etc. tend to be uniform within a country but different between countries. Especially changes of administered prices thus lead us to underestimate the need for intra-country real exchange-rate changes.

Table 4 - Consumer Price Baskets in the EC

	Food and Beverages at home and Tobacco	Manufactured Goods	Rent and Energy (for all purposes)	Services (incl. food in restaurant)	"Non-trade- ables" (Ser- vices and Rent)
W. Germany	29.90	35.11	19.41	15.58	28.40
France	32.70	34.06	13.07	20.17	27.56
Italy	43.30	24.07	13.20	19.52	26.42
United Kingdom	36.00	27.80	20.80	15.40	27.80
Ireland	46.30	21.26	14.92	17.52	24.42
Denmark	32.30	31.40	16.10	20.20	29.20
Netherlands	29.50	29.97	14.33	26.20	35.20
Luxembourg	49.00	31.10	8.30	11.60	11.60
Belgium ^e	32.00	25.00	13.00	30.00	38.00
Average	36.78	28.86	14.79	19.57	27.62
United States	21.62	35.73	26.49	16.16	35.13

Sources*: W. Germany: Statistisches Bundesamt, Fachserie M, Reihe 6;
 France: Institut National de la Statistique et des Etudes Economiques,
 Bulletin Mensuel de Statistique;
 Italy: Istituto Centrale di Statistica, Numeri Indici de Prezzi, Metodi e
 Norme, Serie A, No.12, 1971;
 U.K.: Department of Employment Gazette, March 1974, p.232;
 Ireland: Irish Statistical Bulletin, March 1969;
 Denmark: Danish Statistical Yearbook 1975, Table 221;
 Netherlands: Centraal Bureau voor de Statistiek, Sociale Maandstatistiek,
 Febr. 1972;
 Luxembourg: Service Central de la Statistique et des Etudes Economiques,
 Bulletin, Febr. 1975;
 Belgium: Institut National de Statistique, Bulletin de Statistique,
 Febr. 68 and May 72, and own estimates^e.
 U.S.: Bureau of Labor Statistics, Handbook of Methods, Bulletin 1711.

* I am greatly indebted to Dean Spinanger for providing me with the data for six
 of these countries.

^e - For Belgium the weights had to be estimated because the Institut National de
 Statistique was unable to supply a more detailed breakdown than is published in
 its Bulletin de Statistique, Febr. 1968, p.109. The estimates relate to the basket
 used since 1972.

5. If it is true that nominal exchange-rate changes can facilitate the adjustment of real exchange rates (as has been explained in Section I), the variance between currency areas should be larger than the variance within currency areas even if the need for real exchange-rate changes is the same between and within.

There are thus good reasons to assume that the F-ratios that have been calculated are biased upwards because:

- the inter-country variances are inflated by disturbances that do not reflect differences in economic structure and development, i.e. that have nothing to do with real exchange-rate changes (1-3)¹⁹, and because
- intra-country real exchange-rate changes are hampered by institutional rigidities which prevent them from fully indicating the need for intra-country real exchange-rate adjustments (4,5).

It follows that the results of the comparison of inter- and intra-country variances which has been conducted in Section II, could have been conclusive only if the hypothesis that $R_b > R_w$ had not been rejected. Given that the results have happened to turn out the other way, the upward bias for F becomes fatal - the analysis is inconclusive.

IV. Intertemporal Comparisons of Real-Exchange Rate Changes in the European Community

While comparisons of inter-country and intra-country variances may be vitiated by bias, this is not true for comparisons of the same type of variance during different periods. In the context of this analysis it is notably of considerable interest whether

- the increase in the frequency of nominal exchange-rate changes since mid-1967 has led to an increase in intra-EC real exchange-rate changes (as approximated by R_{EC}),
- the spreading of floating - say from May 1971 (the floating of the DM) onwards - and the oil price explosion have resulted in more intra-EC real exchange-rate variability, and whether
- the need for intra-EC real exchange-rate changes has increased or decreased.

The pooled variances for the first and the second half and for the third and the fourth quarter of the 15 year period 1960-74 are presented in Table 5. As can be seen, the hypothesis that the variance was not larger in the second half than in the first half of the total period can be rejected with a probability of 99 % if quarterly or annual averages are used. Since F_{obs} I also for the four-year averages, it may safely be concluded that real exchange-rate variability in the EC has increased since 1967²⁰. What is more interesting however, is that, again at the 1 % level, there has not been a significant increase in real exchange-rate changes from 1967-70 to 1971-74 for any of the sets of data. Even at the 95 % level, the increase is significant only for the annual data, but not on a quarterly or four-year basis. Nevertheless, the observed variance has increased also over this period.

One may wonder, however, whether this increase in real exchange-rate variability signals an increased need for real exchange-rate changes within the Community. After all, as has been explained in Section I, the changeover from a system of quasi-fixed nominal exchange rates (1959-1966) to exchange rate adjustability (1967-1974) and the transition from the adjustable peg (1967-70) to floating (1971-74) should have facilitated real exchange-rate changes. At the same time, intra-country real exchange-rate changes should have become easier as the rate of inflation has risen, for the downward rigidity of many prices has become less of an obstacle to changes in relative prices within the countries. If we assume that the inter-country increase in real-exchange rate flexibility is at least as large as the intra-country increase, comparisons of inter-country F-ratios with intra-country F-ratios may yield an answer to the question whether also the need for real exchange-rate changes has increased between the EC member countries.

The evidence on intertemporal changes in real exchange-rate variability within W.Germany, Italy and the United States which is summarized in Table 6 forces us to modify our hypothesis.

The comparison of the periods 1960-66 (1962-66^a) and 1967-74 shows an increase in intra-country real exchange-rate variability for the United States, but not for W.Germany and Italy, although the average (compound) rate of inflation for the former period was clearly lower than for the

TABLE 5 - Intertemporal Comparisons of Real Exchange-Rate
Variability in the European Community

t	F _{obs}	df	F(.01)	F(.05)
1. Quarterly Data				
1967 III - 1974 IV		240		
<hr/>	4.31	<hr/>	1.37	—
1960 I - 1967 II		240		
1971 II - 1974 IV		120		
<hr/>	1.35	<hr/>	1.53	1.36
1967 III - 1971 I		120		
2. Annual Data				
1967 - 1974		64		
<hr/>	5.94	<hr/>	1.84	—
1960 - 1966		56		
1971 - 1974		32		
<hr/>	1.92	<hr/>	2.32	1.81
1967 - 1970		32		
3. Four-Year Data				
1967 - 1974		16		
<hr/>	2.87	<hr/>	5.48	3.20
1963 - 1966		8		
1971 - 1974		8		
<hr/>	2.03	<hr/>	6.03	3.44
1967 - 1970		8		

TABLE 6 Intertemporal Comparisons of Real Exchange-Rate Variability for
W.Germany, Italy and the United States

	F_{WG}	df_{WG}	$F^{(.01)}_{(.05)}$	F_I	df_I	$F^{(.01)}_{(.05)}$	F_{US}	df_{US}	$F^{(.01)}_{(.05)}$
				Annual Data					
1967 - 1974 ^a		24			152			112	
<u>1960 - 1966</u>	.70	<u>21</u>	—	.90	<u>95</u>	—	1.91	<u>98</u>	1.39 1.59
<u>1971 - 1974</u>		12			76			56	
1967 - 1970	2.78	—	4.16	3.44	—	1.72	1.66	—	1.87
		12	2.69		76			56	1.57

^a 1967-74/1962-66 for Italy.

latter period in all three instances. There seem to be two explanations for this discrepancy. First of all, the acceleration of inflation was much slower in W.Germany and Italy than in the US: the average rate of inflation exactly trebled in the US (from 1.6 % to 5.8 %) whereas it did not even double in W.Germany (from 2.6 % to 4.3 %) and Italy (from 4.9 % to 7.5 %). However, while this explains why real exchange-rate variability in W.Germany and Italy has not increased in the way it has in the US, it would still lead us to expect an increase also for the two Community countries. It therefore seems reasonable to attribute the actual fall in R_{WG} and R_I to a second factor: the creation of the Common Market. Obviously, the gradual abolition of trade barriers in the Community which had its main effect in the years 1960-66 gave rise to an increased need for real exchange-rate adjustment between the regions of the member countries. The decrease in the need for adjustment after 1966 then seems to have overcompensated the increase in adjustability due to higher national rates of inflation²¹. This means that only F_{US} is likely to be unaffected by significant changes in the need for intra-country adjustment, i.e. that if at all, only the increase in R_{US} may be a suitable measure~~and~~ in determining whether the increase in R_{EC} from 1960-66 to 1967-74 signals an increased need for adjustment or merely increased adjustability. A look at Tables 5 and 6 shows that F_{US} (=1.91) is far smaller than any of the three F_{EC} for this period. Again the comparison is thus inconclusive: since nominal exchange-rate "flexibility" may facilitate real exchange-rate adjustments more than a trebling of the rate of inflation, the fact that F_{EC} F_{US} may fail to indicate an increased need for real exchange-rate adjustment.

The case is different if the periods 1967-70 and 1971-74 are compared: all three countries have experienced an increase in R which is significant at the 5 % level (in the case of Italy it is even significant at the 1 % level). The increase is higher, the faster the acceleration of inflation in the country: it is highest for Italy whose average (compound) rate of inflation has more than trebled (from 3.4 % to 10.9) and lowest for the US where the inflation rate has not even doubled (from 4.7 % to 6.8 %). Inbetween is W.Germany where the average rate of inflation nearly trebled (from 2.2 % to 6.4 %). A comparison with F_{EC} over this period shows that the latter is in fact far lower than F_{WG} and F_I and not much

larger than F_{US} . In other words, the observed increase in real exchange-rate changes between the Community countries from 1967-70 to 1971-74 has been smaller than the corresponding increase within the two Community countries considered. If the assumption is granted that floating has facilitated inter-country real exchange-rate changes at least as much as, say, a trebling of the pace of a trotting inflation facilitates intra-country real exchange-rate changes, it can further be surmised that the need for real exchange-rate changes between the Community countries is no larger (but probably smaller) now than in 1970 when the EC Commission submitted its plans for EC monetary unification. To put it differently: the economic case for European currency unification is as strong now as it was then.

What makes currency unification more difficult now are not increased differences in structural change between the EC member countries, but the increased divergencies between their monetary policies. The increasing need for coordination (or better: for centralisation) of national monetary policies in the Community underlines the importance of finding a way how to save the high-inflation countries the severe and/or drawn-out recession that would be likely to accompany the stabilisation of their inflating national currencies. It underlines the case for currency substitution instead of currency stabilisation, for the creation of a new and stable EC currency (which at first may be a parallel currency) instead of costly (and probably unsuccessful) attempts at EC exchange-rate unification.

V. The Desirability of EC Currency Unification from the Point of View of Individual Member Countries

So far real exchange rate-variability has served us as a criterion for determining whether a given grouping of countries as a whole - the European Community - is a desirable currency area and whether over the last few years the desirability of EC currency unification has increased or decreased. Clearly, however, the pattern of real exchange-rate changes determines also the distribution of the costs and benefits of currency unification among the various members of the union. For the larger a member country's need for real exchange-rate changes vis-a-vis the other

member countries (or the Community average), the less stable will be its domestic equilibrium price level if the average Community price level is kept constant and if the national member currencies are replaced by a Community currency (i.e. exchange rates are fixed).

Real exchange-rate changes of member country A vis-a-vis the Community average can be measured by the squared deviations of A's real exchange-rate changes vis-a-vis a numeraire currency (e.g. the US Dollar) from the (unweighted) average real exchange-rate change of all Community currencies vis-a-vis the same numeraire currency. The results for the period 1960-74, which are shown in Table 7 are roughly in line with what one would expect. Basically three groups of member countries can be distinguished:

- Belgium and Luxembourg which exhibit by far the smallest deviations,
- the UK and Ireland which exhibit by far the largest deviations, and
- the bulk of the other Community countries which fare somewhere in between (with Germany and France at the higher end and Italy, the Netherlands and Denmark at the lower end).

If only the last five years are considered the picture changes very little: the only noteworthy difference is that Ireland and W.Germany change places.

The use of squared deviations implies that both the size and the stability of real exchange-rate changes are relevant. For even if the sum of absolute deviations from the average were the same for all member countries, the sum of squared deviations may be different, i.e. higher for countries whose deviations exhibit strong fluctuations over time, and lower for countries characterised by a constant speed of real exchange-rate change. This peculiarity of the sums of squares concept may be welcome in the context of this study because a stable rate of inflation or deflation can be more easily anticipated and hence imposes a smaller welfare cost on an economy than a wildly fluctuating and hence fairly unpredictable rate of price change. Nevertheless, it is of interest to know the extent to which the ranking of the individual member countries in Table 7 reflects high deviations as compared with unstable deviations. For this purpose the absolute deviations have been summed in Table 8.

As can be seen, the composition of the three groups does not change if

TABLE 7 - Squared Deviations of Real Exchange-Rate Change vis-a-vis
US Dollar from Unweighted Community Average (Annual Data)

	W.Germany	France	Italy	Nether- lands	Belgium	Luxem- bourg	UK	Ireland	Denmark
1960	.01	6.55	.55	1.02	1.19	.77	.42	1.46	.19
1961	11.29	.38	.85	6.86	4.20	6.60	.05	.18	.15
1962	.24	1.96	.58	1.59	5.06	7.67	.30	.32	11.90
1963	.36	1.90	13.10	.02	3.35	1.72	4.49	2.56	5.48
1964	1.96	1.00	1.74	1.51	.12	.31	1.19	5.29	1.37
1965	2.22	2.02	.06	0	.02	.35	.59	.98	1.72
1966	.15	2.43	2.10	6.30	.04	.96	.01	1.06	10.50
1967	.98	.18	.40	.72	.03	.32	4.45	2.22	15.37
1968	2.79	17.47	3.17	12.82	6.45	5.57	74.13	72.59	1.12
1969	.24	6.60	3.76	10.69	.53	4.33	1.56	10.50	.86
1970	34.11	43.43	.77	3.92	.69	.02	.66	7.51	1.00
1971	3.35	7.67	5.43	7.56	3.80	2.37	8.88	6.05	2.10
1972	.96	2.59	4.24	10.11	5.11	3.69	19.71	8.41	.27
1973	94.87	9.18	60.37	33.18	5.52	2.02	144.72	94.28	51.55
1974	.38	29.16	14.59	10.63	4.45	1.30	.20	1.64	15.05
Σ '60-74	153.91	132.52	111.71	106.93	40.52	38.00	261.36	215.05	118.63
Σ '70-74	133.67	92.03	85.40	65.40	19.57	9.39	174.17	117.88	69.97

TABLE 8 - Unsquared Deviations of Real Exchange-Rate Change vis-a-vis
US Dollar from Unweighted Community Average (Annual Data)*

	W.Germany	France	Italy	Nether- lands	Belgium	Luxem- bourg	UK	Ireland	Denmark
1960	- .08	+ 2.56	+ .74	+ 1.01	- 1.09	- .88	- .65	- 1.21	- .44
1961	+ 3.36	- .62	- .92	+ 2.62	- 2.05	- 2.57	+ .23	- .43	+ .39
1962	- .49	+ 1.40	+ .76	- 1.26	- 2.25	- 2.77	+ .55	+ .57	+ 3.45
1963	- .60	+ 1.38	+ 3.62	+ .13	- 1.83	- 1.31	- 2.12	- 1.60	+ 2.34
1964	- 1.40	- 1.00	+ 1.32	+ 1.23	+ .34	- .56	- 1.09	+ 2.30	- 1.17
1965	- 1.49	- 1.42	+ .25	+ .05	+ .14	- .59	+ .77	+ .99	+ 1.31
1966	- .39	- 1.56	- 1.45	+ 2.51	- .20	- .98	- .10	- 1.03	+ 3.24
1967	- .99	- .43	+ .63	+ .85	+ .18	- .57	- 2.11	- 1.49	+ 3.92
1968	+ 1.67	+ 4.18	+ 1.78	+ 3.58	+ 2.54	+ 2.36	- 8.61	- 8.52	+ 1.06
1969	+ .49	- 2.57	- 1.94	+ 3.27	- .73	- 2.08	+ 1.25	+ 3.24	- .93
1970	+ 5.84	- 6.59	- .88	- 1.98	- .83	- .14	+ .81	+ 2.74	+ 1.00
1971	+ 1.83	- 2.77	- 2.33	+ 2.75	- 1.95	- 1.54	+ 2.98	+ 2.46	- 1.45
1972	+ .98	+ 1.61	- 2.06	+ 3.18	+ 2.26	+ 1.92	- 4.44	- 2.90	- .52
1973	+ 9.74	+ 3.03	- 7.77	+ 5.76	+ 2.35	+ 1.42	-12.03	- 9.71	+ 7.18
1974	- .68	- 5.40	- 3.82	+ 3.26	+ 2.11	- 1.14	+ .45	+ 1.28	+ 3.88

Sums of Absolute Deviations from Community Mean

Σ '60-74	30.03	35.28	30.27	33.44	20.85	20.83	38.19	40.47	32.28
Σ '70-74	19.07	19.40	16.86	16.93	9.50	6.16	20.71	19.09	14.03

Variances of Actual Deviations around Country Mean

'60-74	9.49	9.15	7.29	4.18	2.86	2.29	15.90	14.52	5.90
'70-74	17.75	17.89	7.14	7.94	4.12	2.33	36.06	27.59	12.40

Sums of Absolute Year-to-Year Changes in Deviations

'60-74	43.22	43.18	30.66	31.81	16.06	22.16	56.08	54.37	34.76
'70-74	24.04	18.05	11.38	10.24	6.47	7.92	29.66	23.44	14.38

* - A positive sign indicates that dollar prices have risen in this country more than on the Community average, i.e., that the country's real exchange rate has appreciated vis-a-vis the Community average.

the full period 1960-74 is analysed although, within the third group, Germany moves to the lower end and the Netherlands and Denmark shift to a mid-position. What is more interesting, however, is a comparison of squared and absolute deviations for the period 1970-74. It turns out the bad ranking of the UK and Ireland in Table 7 is largely due to the instability of their deviation: in terms of absolute deviations W.Germany and France fare no better than the UK and Ireland.

It may be objected that squared deviations do not properly reflect the instability of real exchange-rate changes because they do not take account of changes in sign. However, a country which, as a result of currency unification and stabilization of the average Community price level, suffered from frequent shifts between however constant rates of inflation and however constant (and possibly identical) rates of deflation might be worse off than a member country which had to live with somewhat fluctuating rates of, say, inflation only. This means that a more precise measure of the stability of real exchange-rate changes is each country's variance over time of the actual (or "relative") deviations from the country's mean deviation.

These variances are also presented in Table 8. It turns out that the above conclusion is indeed supported: the dispersion of the deviations is largest for the UK and Ireland both for the total period and the subperiod. As can also be seen, it is smallest for Belgium and Luxembourg, and in the middle group Germany and France are at the upper end while Italy and the Netherlands are at the lower end. The statistical reliability of these comparisons can be determined by the F-test with 14, 14 degrees of freedom for the total period. The critical F-ratios (one-tailed test) are 2.48 at the 5 % level and 3.70 at the 1 % level. Calculations show that the dispersions for the UK and Ireland are significantly larger than those of Luxembourg ($F_{UK,LUX} = 6.94$, $F_{IRL,LUX} = 6.34$), Belgium ($F_{UK,B} = 5.56$, $F_{IRL,B} = 5.08$) and the Netherlands ($F_{UK,N} = 3.80$, $F_{IRL,N} = 3.47$), and that even the dispersions for W.Germany and France are significantly larger than those of Luxembourg ($F_{WG,LUX} = 4.14$, $F_{F,LUX} = 4.00$) and Belgium ($F_{WG,B} = 3.32$, $F_{F,B} = 3.20$).

Even these propositions about the dispersion of each country's deviations from the Community average are, however, vulnerable to the objection that

they do not take account of whether in each time series there are frequent changes of signs back and forth or whether the sign changes only, say, once. In order to remedy this deficiency and measure real exchange-rate stability in its most relevant sense, the absolute year-to-year changes in deviations were summed for each country (Table 8, bottom). These results, too, corroborate the conclusion that real exchange rates vis-a-vis the other member countries were most stable for Belgium and Luxembourg and least stable for the UK and Ireland both for the total period and the subperiod, but in addition indicate the following:

- more recently (1970-74) the German real exchange rate was even less stable than the Irish one (though still more stable than the British);
- in both the total period and the subperiod the divergence between the results for W.Germany and France, on the one hand, and Italy, the Netherlands and Denmark, on the other hand, is so large that these five countries should be grouped in two different categories rather than in what has been called the "middle group".

The conclusion that Belgium and Luxembourg will gain most, and that the UK and Ireland will gain least, from EC currency unification may not only be justified with regard to real exchange-rate changes. Currency unification will eliminate transaction and information costs as well as exchange-rate risks and exchange-control risks within the Community which presently hamper trade and capital arbitrage. Hence, the gains of currency unification will be the larger for a member country, the more "open" its economy, both commercially and financially. As small and central Community countries, Belgium and Luxembourg should be among those member countries which will benefit most from trade creation and the removal of obstacles to capital arbitrage which currency unification will imply. The UK and Ireland, on the other hand, are peripheral Community members and hence less open towards the rest of the Community²².

VI. Summary and Conclusion

It has been argued in this paper that the need for intra-group real exchange-rate changes is the main economic criterion for the desirability of currency unification because the degree of (unhampered) real exchange-

rate variance determines the extent to which national rates of inflation or deflation will have to diverge from zero if exchange rates are fixed and the average Community price level is kept constant. This need not mean that there are no other economic criteria. While the variance of inflation rates has been exposed as an essentially political criterion, there remain such economic criteria as factor mobility (Mundell), exchange-rate illusion (Mundell, McKinnon), diversification (Kenen) and cross-border intra-group transaction costs (Mundell, Corden)²³. It should be noted, however, that these characteristics are all reflected by the real exchange-rate criterion.

First of all, the more mobile the factors of production, the greater is the price elasticity of factor supply to producers in each region and industry, the greater hence the price elasticity of commodity supply by producers and the smaller therefore the terms of trade effect (= price effect) of shifts in demand for products of individual regions. Thus a high degree of factor mobility will (*ceteris paribus*) result in small real exchange-rate changes²⁴. Moreover, if factors of production are highly mobile, there will be fewer attempts at real exchange-rate depreciation to reduce real wages and hence unemployment in depressed regions. If these attempts are not completely unsuccessful, we will observe larger real exchange-rate changes where factor immobility permits the continued existence of regional unemployment.

Secondly, shifts in the terms of trade will be the smaller, the more diversified the member economies and hence the pattern of trade between them. Since real exchange-rate changes reflect, *inter alia*, changes in terms of trade, they allow also for the degree of diversification.

While factor mobility and diversification are criteria which concern the macroeconomic need for adjustment, the criterion of exchange-rate illusion concerns the efficiency of (nominal) exchange-rate adjustment. But again real exchange-rate variance can be shown to indicate the extent to which this criterion is met. If there were no exchange-rate illusion, nominal exchange-rate changes would not produce real exchange-rate changes. (At the same time, there is likely to be very little money illusion, so that inflation and deflation could not do so either). Hence, if the exchange-rate instrument has lost efficiency, this will show off in a small real exchange-rate variance.

While real exchange-rate variance need not be an accurate indicator of the microeconomic gains in the efficiency of cross-border intra-group transactions²⁵, it stands out as a comprehensive criterion for determining whether, from the point of view of macroeconomic stabilisation, currency unification is desirable for any chosen group of countries. Moreover, it has the very important advantage of being measurable, i.e. "operational".

In Section II of this paper it has been shown that in 1960-74 observed real exchange-rate changes have been significantly larger for the Community of the Nine than for regions/cities of W.Germany, Italy and the US irrespective of the time span over which real exchange rates were averaged. However, it has been argued in Section III that this comparison is not conclusive because, for various reasons, the observed EC real exchange-rate variance overstates the Community's need for real exchange-rate adjustment, while the observed intra-country variances understate the need of real exchange-rate adjustment within the three national currency areas considered.

This bias is avoided if the same type of variance is compared over different periods (Section IV). Our results show, for example, that from 1967-70 to 1971-74 real exchange-rate changes have not increased more between the nine EC member countries than within the two member countries concerned. Given that real exchange-rate adjustment is facilitated at least as much by flexibility of nominal exchange rates as by marked increases in the rate of inflation, it has been concluded that the need for real exchange-rate changes between the Community countries is no larger now than it was in 1970 and thus that, from an economic point of view, EC currency unification is as desirable now as it was then.

Finally, in Section V, it has been shown that, if we are justified in extrapolating from the past (1960-74) into the future, EC currency unification and constancy of the average domestic price level in the Community will imply by far the highest and least stable deviations from national price level constancy for the UK and Ireland and by far

the lowest and most stable deviations for Belgium and Luxembourg. If only the more recent subperiod 1970-74 is chosen as a basis for prediction, this conclusion holds as well, with the minor modifications that W.Germany overtakes Ireland (but not Britain) in terms of real exchange-rate instability vis-a-vis the rest of the Community, and that both W.Germany and France show as high deviations from the Community average as the U.K. and Ireland.

Footnotes

- ¹ The concept of the "desirable" currency area should be distinguished from the concept of the "optimal" currency area. While the theory of the optimum currency area tries to answer the question which countries or regions should combine to form a common currency area, the question here is whether a given group of countries fares better under exchange rate flexibility or in a currency union. On this distinction see eg. N.N.Mintz - "Monetary Union and Economic Integration", in: New York University, Graduate School of Business Administration, Institute of Finance, Bulletin No.64, April 1970, p.22; and B.Balassa - "The Theory of Economic Integration", 1961, p.273.
- ² The argument is based on the relative purchasing-power parity doctrine (for a survey and critique see e.g. Bela Balassa - "The Purchasing-Power Parity Doctrine: A Reappraisal", Journal of Political Economy, 1964, reprinted in: "International Finance", R.N. Cooper (ed.)). In the framework of the theory of the optimum currency area it has been extensively discussed by Giovanni Magnifico (cf. his "European Monetary Unification", 1973, e.g., p. 10 ff., 62 ff.).
- ³ Cf. Marcus Fleming - "On Exchange-Rate Unification", in: Economic Journal, Sept. 1971; and Bela Balassa - "Monetary Integration in the European Common Market", in: "European Economic Integration", ed. by B.Balassa, North-Holland 1975, p.186-91, 220.
- ⁴ For a formula describing the conditions under which differential productivity increases in two countries are consistent with trade balance equilibrium under fixed exchange rates see H.G.Johnson - "Increasing Productivity. Income-Price Trends, and the Trade Balance", in: Economic Journal, 1954.
- ⁵ For the latter point see R.I.McKinnon - "Monetary Theory and Controlled Flexibility in the Foreign Exchanges", in: "Stabilisation Policies in Interdependent Economies", ed. by E.Claassen and P.Salin, North-Holland 1972, p.23. That the purchasing-power parity doctrine should not be formulated with respect to consumer prices is emphasized, for example, by Balassa (1964), op.cit., p.204 ff., by Herbert Giersch - "Wachstum, Inflation und Konzentration", in: Die Aussprache, 1965, p.210, and by McKinnon, op.cit., p.20 ff.
The IMF in its 1975 Annual Report (p.31 ff.) also uses the wholesale price index when comparing effective exchange-rate changes with inflation rate differentials. The wholesale index is more suitable as an indicator of the prices of tradables than the export price index because it includes importables and does not give undue weight to commodities for the production of which the country has a strong comparative advantage.
- ⁶ Both Balassa (1964, p.208) and McKinnon (p.22) show that the general price level tends to rise faster than the wholesale price index (and even more than the export price index) and that the divergence is the larger, the larger are increases in productivity. Fels has regressed the divergence between various domestic price indices and the export price index in eight western countries on their rate of productivity increase in 1955-65 and obtained significant coefficients of correlation for all indices (cf. Gerhard Fels, "Der internationale Preiszusammenhang", Monograph Series "Annales Universitatis Saraviensis, No.46, 1969, Ch.4, esp.p. 116 ff.). The reason for this statistical "law" is that productivity

in the tradables sector (mainly manufacturing and agriculture) rises faster than in the non-tradables sector (mainly services), so that equalisation of wage increases in both sectors leads to larger price increases (smaller price decreases) in the service sector than in the manufacturing and agricultural sector (cf. Balassa, Giersch, McKinnon, Fels, op.cit.). Since expenditure for services and rent (as a proxy for non-tradables) occupies a weight of more than 1/4 in the average EC consumer basket with a considerable variance around this unweighted mean (compare Table 4), it should be expected that differences in productivity increases have affected our measure of real exchange-rate changes at least as much via index divergences as via the terms of trade for tradables. Note, however, that the ToT effect and the "index effect" of differences in productivity increases in our real exchange-rate measure will tend to cancel out to some extent: while an increase in productivity in country A will - ceteris paribus - tend to worsen its terms of trade, it will tend to increase the excess of A's consumer price index over its tradables price index. That this compensatory effect is not perfect is witnessed by the finding of M.L.Stecker ("Intercity Differences in Costs of Living in March 1935 - 59 Cities", New York 1971, reprint, p.134) that differences in commodity prices between cities amounted to only 1/6 of the differences in the cost of services and other products the prices of which "for the most part are locally determined".

For a correlation analysis of various W.German price indices cf. the unpublished study "Läßt sich der Zusammenhang von Preisbewegungen in Konsumgütern und Konsumgüterfernen Bereichen an der Entwicklung von Preisindizes für Produktion, Großhandel und Einzelhandel ablesen?" by G.Flemig, K.-D. Schmidt und R.Soltwedel (Institut für Weltwirtschaft an der Universität Kiel, March 1974). The authors did not find a significant correlation between the consumer price index and (lagged values of) the index of industrial selling prices of consumer goods (p.63, 66 - regressions for levels and first differences) except when excluding food, beverages, tobacco and rent from the CPI.

- 7 Hans Genberg - "A Note on Inflation Rates under Fixed Exchange Rates", Graduate Institute of International Studies, May 1974, mimeo. Genberg's study covers the period 1959-1970. He uses quarterly changes in the CPI.
- 8 In this comparison no specific statistical test (like the F-test) can be applied. Genberg is merely able to point out that the F-ratio is no greater on the average for the OECD than for the fifteen US cities chosen.
- 9 Op.cit., p.3, Fn.3.
- 10 H.B.Junz and R.R.Rhomberg - "Price Competitiveness in Export Trade among Industrial Countries", in: American Economic Review, May 1973, p.412 ff.
- 11 Only the exchange-rate averages between the US Dollar and the Danish Kroner for 1959-61 II had to be estimated from end-of-month data published in : International Financial Statistics by the International Monetary Fund.
- 12 These indices are calculated with regard to the same (federal) basket of goods purchased by a four-person household living on mean earned income. The basis used was 1962 except for W.Berlin from 1958 to 1961. Since the Saarland has started the calculation of its index in July 1959, the federal index was used for the period 1959 I - 1959 II. The sources are

- Landesamt für Datenverarbeitung und Statistik, Nordrhein-Westfalen, Statistische Berichte, M 12 - m 8/75;
 - Statistisches Landesamt Baden-Württemberg, Preisindex für die Lebenshaltung in Baden-Württemberg, Sonderausgabe 1974 (the data for Aug.-Dec. 1974 were supplied to me by the Statistisches Bundesamt);
 - Statistisches Amt des Saarlandes, Statistische Berichte MI2 - m 8/75;
 - the data for W.Berlin were supplied to me by the Statistisches Bundesamt.
- 13 The frequency distributions, too, yield the same conclusion as in the case of the quarterly data, but, as has been shown, this holds only with a probability of 97.5 %.
- 14 The cities are Atlanta, Baltimore, Boston, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St.Louis, San Francisco, Seattle and Washington. The Bureau of Labour Statistics give also complete series from 1959 to 1974 for Houston, Kansas, Milwaukee and Minneapolis, but it was considered preferable to use the same sample as Genberg has done to maximise comparability of our results.
- 15 The cities are Torino, Aosta, Milano, Trento, Venezia, Trieste, Genova, Bologna, Firenze, Perugia, Ancona, Roma, L'Aquila, Campobasso, Napoli, Bari, Potenza, Reggio di Calabria, Palermo and Cagliari (source: Annuario Statistico and Bolletino Mensile of the Italian Central Statistical Office).
- 16 The observed $F_{I,WG}$ is equal to 2.38 while the critical $F_{247,45}$ at the 1 % level of significance is 1.80. R_I is also significantly larger than R_{US} : the observed $F_{I,US}$ of 2.52 clearly exceeds the critical 1 % $F_{247,210}$ of 1.38. Surprisingly, R_{US} is even smaller than R_{WG} , but the difference ($F_{WG,US} = 1.06$) is not significant at the 1 % level ($F_{45,210} = 1.64$) or even the 5 % level ($F_{45,210} = 1.43$). One possible explanation is that R tends to be smaller for a sample of cities than for a sample of regions which are urbanised to different degrees. However, since the Italian indices are also city indices, this means that the above calculations even underestimate the difference in intra-country real exchange-rate variability between W.Germany and Italy. (The hypothesis that the dispersion between regions and small towns is larger than for large cities is supported by the findings of M.L.Stecker, (op.cit., p.125). Another explanation may be that the formation of the EEC has resulted in particularly large structural adjustments (real exchange-rate changes) between the regions of the individual member countries.
- 17 For a different classification see Ch.Vannerau - "Comparability of Consumer Price Indices in OECD Countries", OECD Economic Outlook, Occasional Study, July 1975.
- 18 For this point see also J.P.Henderson - "An Intercity Comparison of Differentials in Earnings and the City Workers' Cost of Living", Review of Economics and Statistics, Nov.1955, p.407 ff. Of course, this objection need not apply to a comparison of the EC and the US.

- 19 It might be objected that the other sources of disturbances may also compensate for real exchange-rate changes and thus reduce the observed variance. However, if they have the opposite sign, they may also over-compensate real exchange-rate changes to such an extent that the observed variance becomes again larger than the real exchange-rate change. Hence the probability of an increased variance (bias) remains. Note also that the law of large numbers (which would lead us to expect a reduction in variance) does not apply because the means around which our variances are measured do not represent expected values in any statistical sense.
- 20 Cf. also the results of V. Ginsburgh who conducted a principal component analysis of retail price indices in the Common Market countries and found that prices (unadjusted for exchange-rate changes) were not significantly more correlated in 1965-70 than in 1960-65 (Victor A. Ginsburgh - "The Common Market Economies: Interdependence or Independence", European Economic Review, Oct. 1973).
- 21 Clearly, trade liberalisation in the Community must also have raised the need for adjustment between the member countries in 1960-66, but this is not inconsistent with the measured increase of R_{EC} from 1960-66 to 1967-74 because the effects of the decrease in the need for adjustment may have been overcompensated by the effects of the increase in the ease of adjustment due to nominal exchange-rate flexibility.
- 22 From the point of view of smallness, currency unification should be more attractive to Ireland than to the UK, but the UK may instead benefit from the "openness" of its financial sector, i.e. the leading role of London as a European financial centre.
For some approximative evidence on the openness of the Common Market countries see e.g. R.I. McKinnon - "Optimum World Monetary Arrangements and the Dual Currency System", in: Banca Nazionale del Lavoro, Quarterly Review, Dec. 1963; and R.G. Hawkins - "Intra-EEC Capital Movements and Domestic Financial Markets", in: "International Mobility and Movement of Capital", ed. by F. Machlup, W.S. Salant, L. Tarshis, NBER 1972, esp. Section 3 (p. 60 ff.).
- 23 Cf. R.A. Mundell - "The Theory of Optimum Currency Areas", in: American Economic Review, 1961; R.I. McKinnon - "Optimum Currency Areas", in: American Economic Review, 1963; P. Kenen - "The Theory of Optimum Currency Areas: An Eclectic View", in: "Monetary Problems of the International Economy", ed. by R.A. Mundell and A.K. Swoboda, Chicago/London 1969; Max Corden - "Monetary Integration", Princeton Essay in International Finance, no. 93, April 1972.
Note that both McKinnon and Corden use the criterion of "openness", but while McKinnon is interested in its macroeconomic implications, Corden concentrates on the microeconomic gains in monetary efficiency of international transactions which currency unification would afford.
- 24 Of course, a higher price elasticity of supply implies at the same time higher terms-of-trade effects of differential increases in productivity. But as has been pointed out in Footnote 6, the real exchange-rate effects of productivity-induced changes in the terms of trade will tend to be (partly) compensated or overcompensated by the excess of consumer price increases over export and wholesale price increases.

- 25 Nevertheless, real exchange-rate variance is likely to be an indirect and approximative indicator of such efficiency gains. For the size of potential efficiency gains will depend on the openness of the member economies with respect to each other, openness, however, favours real exchange-rate stability because
- it tends to result in a high degree of diversification of intra-group trade and financial arbitrage, and
 - it leads to erosion of exchange-rate illusion.

It is therefore no coincidence that, in Section V, two very open economies (Belgium and Luxembourg) turned out to have experienced the smallest and most stable changes of real exchange rates vis-a-vis the rest of the Community.

The link between micro- and macroeconomic welfare aspects which the openness criterion establishes is also the reason why currency unification can be left to the market, i.e. why the process and pattern of expansion of an attractive European Parallel Currency (defined as an indexed basket of member currencies) would conform also the macroeconomic optimality criteria of the theory of currency areas.