IMF WORKING PAPER

WP/91/25

INTERNATIONAL MONETARY FUND

European Department

Real Exchange Rates and Competitiveness: A Clarification of Concepts, and Some Measurements for Europe 1/

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March 1991

Abstract

This paper examines indicators of competitiveness. It analyzes the conceptual foundations of conventional measures of the real exchange rate and finds that inferences about competitiveness from these indicators require strong, and in many cases implausible, assumptions. Based on this analysis some alternative measures are proposed and their use is illustrated using data from Europe. Given the usefulness of standardized indicators, four simple charts are proposed; these help solve some conundrums in the European data and provide the basis for a richer set of inferences about competitiveness.

JEL Classification Numbers:

410, 430, 620

1/ This paper has benefited from discussions with Bob Traa, from comments by Lars Svensson and by many colleagues in the European Department, and from the analysis in Marston (1986).

Contents

Summary

This paper examines indicators of competitiveness. It analyzes the conceptual foundations of conventional measures of the real exchange rate and finds that inferences about competitiveness from these indicators require strong, and in many cases implausible, assumptions. Based on this analysis some alternative measures are proposed, and their use is illustrated using data from Europe.

A useful indicator of competitiveness should possess one critical property: when it points to a loss of competitiveness by a country, the producers of traded goods in that country should see an erosion of their shares in both domestic and foreign markets. Two conventional indicators are examined, one based on relative unit labor costs in the traded goods sector in a common currency, and the other based on aggregate price indices in a common currency.

The intuition behind real exchange rates based on labor costs in the traded goods sector is that they provide a measure of relative profitability. In fact, shifts in the external terms of trade (reflecting imperfect substitutability of traded goods) or differences across countries in the path of input costs also affect relative profitability. The analysis in the paper indicates that one can get a better measure of competitiveness by comparing across countries the labor share in manufacturing value added--that is, unit labor costs divided by the value-added deflator in manufacturing. The inverse of the labor share is an indicator of the profit margin. There are, however, many less tractable problems with real exchange rates, whether based on unit labor costs or profit margins, problems related to differences in technology and productivity growth. These are spelled out so as to make clear exactly what weaknesses exist in all of the indicators.

Real exchange rates based on aggregate price indices are used implicitly to draw inferences about the internal terms of trade between traded and non-traded goods. But such inferences can be inaccurate because of imperfect price arbitrage in traded goods, or intersectoral differences in the growth of productivity. To some extent these weaknesses can be corrected. No matter how one defines the real exchange rate, it is difficult to determine whether a movement in the real exchange rate represents a new change in competitiveness or an endogenous equilibrating response to some earlier change.

A numerical analysis of the evolution of the competitive position of the Federal Republic of Germany vis-à-vis other countries in the exchange rate mechanism of the European Monetary System is used to illustrate the theoretical discussion. Given the usefulness of standardized indicators, four simple charts are proposed; these help solve some conundrums in the European data and provide the basis for a richer set of inferences about competitiveness.

I. Introduction and Summary

The prospect of the completion of the single market program in the European Community and of movement toward currency union has reinforced the concerns of policymakers about competitiveness. The most common measure of a country's price and cost competitiveness is the real exchange rate (RER)--that is, a nominal exchange rate adjusted for some measure of the discrepancy between a country and its trading partners in cost or price inflation. Both bilateral and effective RERs 1/ are monitored carefully in Europe and, at times of realignments of currencies participating in the exchange rate mechanism (ERM) of the European Monetary System (EMS), they play a role in the determination of the size of the realignment.

It is clear that RER calculations are influential but there is less clarity as to what phenomena these calculations reflect. This lack of clarity has been brought into sharp relief recently by the divergences between different measures of RERs in Europe. Chart 1, for example, illustrates the inconsistency between two widely used measures of the RER for the Federal Republic of Germany (FRG) one based on relative unit labor costs in manufacturing and the other on relative consumer price indices. This inconsistency raises questions as to what the alternative indicators actually measure and how they should be used by policymakers.

To address these questions, section II explores the conceptual basis for conventional measures of competitiveness. Underlying the analysis is the presumption that an indicator of competitiveness should possess one critical property: when it points to a loss of competitiveness by a country, the producers of traded goods in that country should see an erosion of their shares in both domestic and foreign markets. This criterion is used to assess two measures of competitiveness--one based on labor costs in traded goods' activities and the other on aggregate price indices.

The intuition behind RERs based on labor costs in the traded goods' sector is that they provide a measure of relative profitability. Labor costs are, however, only one element of the profit calculation: shifts in the external terms of trade (reflecting imperfect substitutability of traded goods) or differences across countries in the path of materials input costs also affect relative profitability. The analysis in this paper suggests that a better indicator of competitiveness is relative unit labor costs in relation to value added deflators; this is a measure of relative profit margins (or profit shares in value added).

1/ Much has been written on the calculation of appropriate weights for an effective exchange rate--see Artus and Rhomberg (1973), Thakur (1975), Bélanger (1976), Rhomberg (1976), Feltenstein and others (1979), Lipschitz (1979), and Lipschitz and Sundararajan (1980). This question is not addressed in the present paper.

There are, however, other less tractable problems with RERs based on labor costs or profit margins. First, relative profit margins may not be a good guide to developments in rates of return on capital if there are significant differences in technology - profits per unit of output may fall relative to competitors, but, if capital used per unit of output falls even more, profits per unit of capital will increase faster than for competitors. 1/ Unfortunately, data are rarely adequate to compare developments in capital productivity across countries. The second problem is that unit labor costs and profit margins are themselves endogenous (as are rates of return) and will vary as producers adjust to changes in the competitive environment. 2/ It is, thus, rarely clear whether a particular shift in relative unit labor costs (or relative profit margins) reflects a new change in the environment or an equilibrating response to an earlier change.

The intuition behind measures of competitiveness based on aggregate price indices is that they give an indication of differences across countries in the extent of resource pulls between traded and nontraded goods sectors. Specifically, if prices of traded goods in different countries are closely related through international competition, then a real appreciation of the currency based on aggregate prices would suggest that developments in the internal terms of trade are more favorable to nontraded goods in the appreciating country. From this it is implicitly inferred that resources are being drawn out of the production of traded goods into that of nontraded goods at a faster pace

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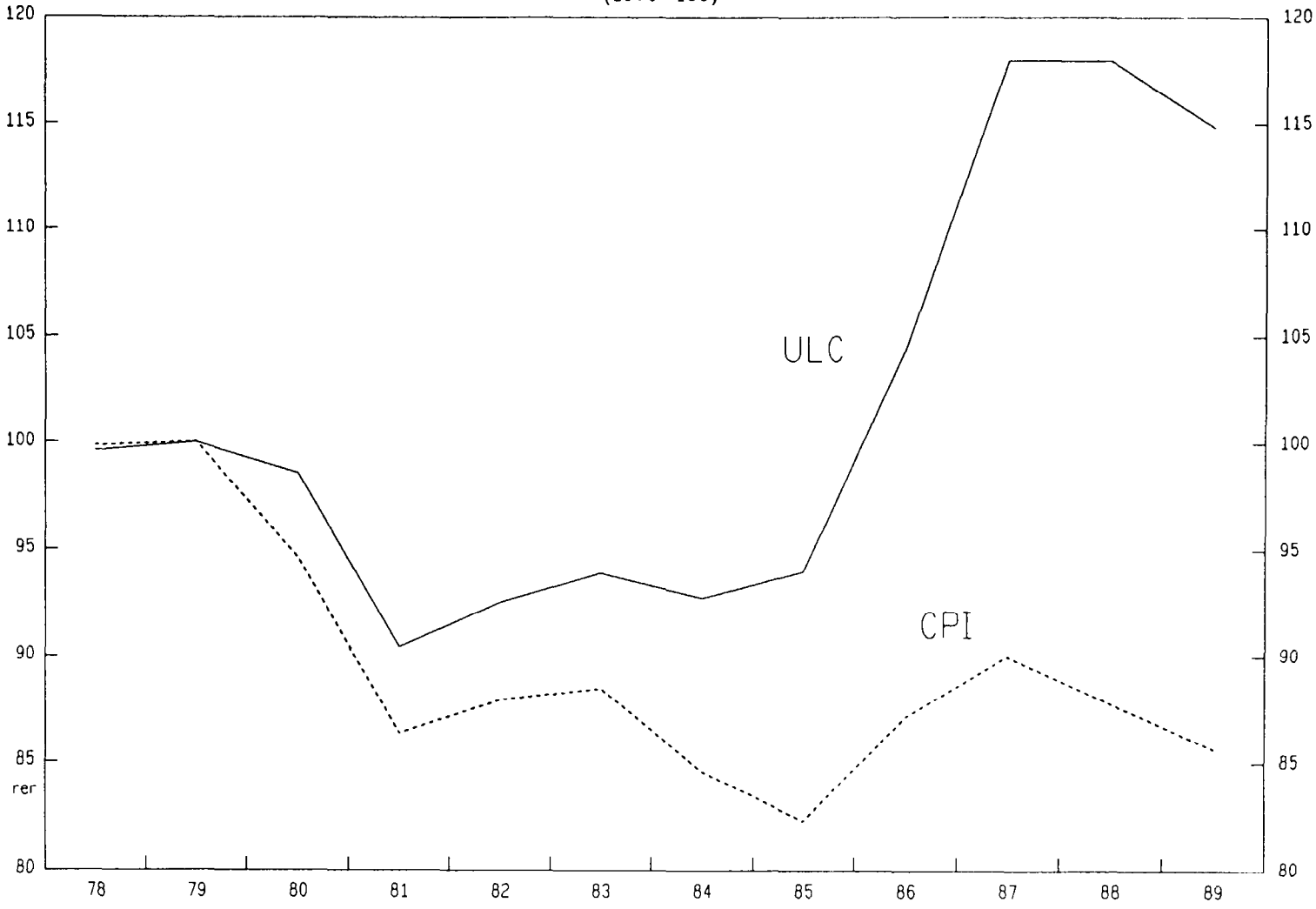
1/ Technology is interpreted as including institutional as well as technical factors that impinge upon production possibilities. Both static and dynamic differences in technology may be important. A static difference might, for example, relate to the degree of factor substitutability across countries. A producer with a more responsive productive structure will boost output more for any given favorable development in the cost-price environment and, thus, enjoy a larger increase in capital productivity. Such a producer might be able to absorb a larger increase in unit labor costs without reducing his rate of return on capital. Dynamic differences might relate to unequal rates of technological progress.

2/ Consider a firm which experiences increased profitability of production owing, for example, to an exogenous currency depreciation. In response to an initial decline in the ratio of unit labor costs to the price of value added (an improvement in the profit margin), it will begin to expand production by adjusting its use of variable factors; in this process, the ratio of unit labor costs to the price of value added will rise. Ironically, the more flexible the production technology and thus the more responsive it is to the improved competitive position, the larger will be the erosion of the initial "improvement" in the profit margin; however, while profit margins decline as firms move up their short-run supply curves, total profits and the rate of return on capital increase. The erosion of the initial improvement in the profit margin will continue in the medium-term as the capital stock is adjusted to the improved profitability; indeed in this time frame the rate of return to capital will begin to fall back.

Chart 1

Germany
Real Effective Exchange Rates 1/
(1979=100)



Source: IMF, Data Fund.
1/ An increase denotes real effective appreciation for Germany. ULC denotes the real effective exchange rate based on relative unit labor costs in manufacturing, and CPI denotes the real effective exchange rate based on relative consumer price indices.

than in other countries--a process that should weaken the external trading position of the appreciating country.

There are a number of difficulties in drawing such inferences from indicators based on aggregate price indices. First, because traded goods are usually not perfect substitutes, the implicit assumption of traded goods arbitrage is unrealistic and it is thus not clear what one can infer about the internal terms of trade in one country relative to its partners from changes in a measure of the real exchange rate which is based on some aggregate price index. Second, developments in relative prices do not necessarily reflect the evolution of factor rewards across sectors when productivity developments are different across sectors. 1/ Third, if productivity growth is particularly fast in the traded goods sector, some reallocation of resources to the nontraded sector may be appropriate to ensure a balanced availability of traded and nontraded goods. A shift in the internal terms of trade required to achieve such a reallocation need not imply that producers of traded goods are losing market shares vis-à-vis foreign producers. Finally, as in the case of the labor-cost-based indicators, there are problems with timing. Specifically, it is virtually impossible in practice to determine whether a change in the internal terms of trade reflects new developments in cross-sectoral factor rewards, setting up incentives for shifts in resource allocation, or an adjustment to previous changes, reflecting the ongoing process of factor allocation.

In section III, the points that emerge from the theoretical discussion are illustrated in a numerical analysis of the evolution of the competitive position of the FRG vis-à-vis its partner countries in the ERM. The numerical examples suggest that a much richer array of inferences can be drawn from the available data than those that emerge from the conventional indices. Given that there is some value to producing standardized indicators, four simple charts are proposed; these help reconcile apparently contradictory evidence from the conventional RERs and provide the basis for a more informed discussion of competitiveness.

II. Concepts of the Real Exchange Rate

1. Measures focusing on costs in the traded goods' sector

One of the most widely used measures of competitiveness looks at unit labor costs in the production of traded goods. It is calculated as the ratio of unit labor costs in the home country to unit labor costs in its trading partners, with all data expressed in a common currency:

$$(1) \qquad RER_{ULC} = (ULC_T/ULC_{T^*}).NER$$

1/ This is the old argument about productivity biases, first raised by Balassa (1961; 1964), which will be examined in some detail in the following sections.

where ULC_T and ULC_{T*} are respectively unit labor costs in the traded goods sectors of the home country and its trading partners, and NER is the nominal effective exchange rate. The logic underlying this measure is that, since final goods prices (expressed in a common currency) are linked by competition in the market place, developments in relative unit labor costs (adjusted for nominal exchange rate developments) are indicative of changes in relative profitability (specifically, unit profits) in the traded goods' sectors of the two countries. It should thus be possible to infer changes in incentives to produce traded goods in the home country relative to its trading partners from the movements of RER_{ULC}.

To explore this interpretation, assume that traded goods are produced according to a two-tier production function. In the first tier, value added (V_T) is determined by capital (K_T), labor (L_T) and technical progress over time (t). Output (Q_T) is related to value added, inputs of nontraded goods (I_{NT}), and imported inputs (I_{MT}):

$$(2) \qquad Q_T = f_T\,[V_T(L_T, K_T, t),\ I_{NT},\ I_{MT}]$$

It is assumed that the value added function is characterized by constant elasticity of substitution between capital and labor, with an elasticity of substitution of less than one, 1/ and that the remaining factors, intermediate inputs, are combined in fixed proportions with value added in the production of output. 2/

a. Basic case

It is easiest to start with the short run and leave aside temporarily questions raised by intermediate inputs and differences across countries in technologies and goods produced. 3/ In the short run, when capital is a fixed factor, V_T (and therefore Q_T) can be written as a negative function of the ratio of unit labor costs (ULC_T) to the value added deflator (PV_T) in the traded goods sector, with the return to a physical unit of capital (r_T) also a negative function of the same ratio (see Appendix).

$$(3) \qquad \hat{V}_T = -\alpha_T \cdot \psi_{LT} \cdot (\hat{ULC}_T - \hat{PV}_T)$$

$$(4) \qquad \hat{r}_T = \hat{PV}_T - \beta_T \cdot \psi_{LT} \cdot (\hat{ULC}_T - \hat{PV}_T)$$

1/ Empirical work has tended to find an elasticity of substitution between labor and capital of significantly less than 1. See, for example, Artus (1984), Lipschitz and Schadler (1984), and McDonald (1988a).

2/ The degree of substitutability between value added and intermediate inputs is not crucial to the analysis.

3/ Homogenous goods are subject to the law of one price, when prices are expressed in a common currency.

where $\psi_{LT} = \phi_{LT}/(1-\phi_{LT})$ and ϕ_{LT} is the labor share in value added, $\alpha_T = \sigma/(1-\sigma)$, $\beta_T = 1/(1-\sigma)$, σ is the elasticity of substitution between capital and labor in the first tier of (2), and $\hat{}$ over a variable denotes a percentage change.

Equations (3) and (4) illustrate how RER_{ULC} can be interpreted as an indicator of relative profitability in the production of traded goods in the domestic economy vis-à-vis trading partners. Assume that there is an improvement in the competitiveness of the home country due, for example, to an autonomous depreciation of its currency. With prices unchanged in terms of foreign currency and ULCs unchanged in partner countries there is no change in value added abroad. However, ULC_T falls relative to PV_T leading to an increase in domestic value added (equation 3). The gain in the home country's market share reflects an increase in the return to capital in foreign currency terms relative to the foreign country (equation 4). 1/

It is useful to trace the response of producers in the home country to the depreciation of its currency. With a given foreign currency price for its output of traded goods, the ratio of the price of value added in the traded goods sector to marginal cost in that sector (MC_T) increases and this is reflected in an increase in the ratio of PV_T to ULC_T at the original output level. Given the gap between PV_T and MC_T, producers have an incentive to expand output and do this until PV_T and MC_T are again equal. As producers expand output and thus move up the short-run supply curve, unit labor costs increase as the average product of labor falls; total profits also increase, and with a fixed capital stock, the rate of return rises. When the equality between MC_T and PV_T is restored, the ratio of ULC_T to PV_T remains below the level prevailing prior to the devaluation. 2/ Thus, associated with the increase in output and market share (there has been no change in production conditions in the rest of the world), there is an improvement of competitiveness based on a comparison of the final RER_{ULC} with that prior to the devaluation.

1/ The percentage increase in PV_T is in line with the exchange rate change, but the increase in r_T is larger. It is the relative return to a physical unit of capital in foreign currency terms that is relevant for comparing short-run output developments across countries. To see this, consider a devaluation accompanied by equal proportionate increases in the nominal return to a unit of capital and in wages. There would be no incentive to increase production although the return to a unit of capital in domestic currency terms has risen. Note that if capital goods are to some extent nontraded, the return to a unit of capital in foreign currency terms is not necessarily the most relevant variable for considering international investment decisions.

2/ With $\sigma < 1$, as a firm moves up its short-run supply function, ULC increases at a slower rate than MC; this reflects the fact that marginal product is falling at a faster pace than average product.

Interpreting RER_{ULC} as a measure of relative profitability is, however, based on a number of rather crucial assumptions. The analysis thus far has assumed that products and technology are homogeneous acros countries and that intermediate goods are not used in the production process. Moreover, it has left aside issues related to the time dimension of the analysis, reflected, in part, in the assumption of a fixed capital stock. The effects of relaxing these assumptions are examined below.

b. Introducing product differentiation and intermediate goods

The intuitive basis of RER_{ULC} as an indicator of competitiveness is that it provides a measure of developments in profitability (specifically, unit profits) in the traded goods' sector vis-à-vis the traded goods' sectors in partner countries. Labor costs are, however, only one element of the profit calculation; relative profitability might change owing to variations across countries in the price of output or in the cost of material inputs. Looking first at price variations, it is useful to introduce an alternative measure of competitiveness based on value added prices for traded goods output,

$$(5) \quad RER_{PVT} = (PV_T/PV_{T*}). \ NER$$

When traded goods produced by different countries are homogeneous, such an indicator is of little value as a measure of competitiveness--prices of goods produced by different countries will never diverge when expressed in a common currency. 1/ However, when traded products are not homogeneous, price based indicators should also indicate a gain in competitiveness in the depreciation scenario considered in the previous subsection. After the depreciation, the home country begins to increase its output; to sell this increasing output, foreign currency prices need to be lowered relative to competitor countries. In the final equilibrium PV_T has fallen relative to PV_{T*} expressed in a common currency. The remainder of the story remains the same as outlined in subsection 1.a above, with an increase of the ratio of PV_T to ULC_T supporting the increase in output in the home country. The key to the improved competitiveness is not that PV_T has fallen relative to PV_{T*} in common currency terms but that relative profitability has improved in the home country as measured by the ratio of PV_T to ULC_T, compared with the same ratio for partner countries.

Introducing heterogenous traded goods means that one has to consider influences affecting demand; RER_{PVT} is likely to be a poor guide to competitiveness developments in the face of demand shifts. Thus, if demand switches away from the goods produced by the home country, one would expect the foreign currency price of its traded goods output to decline relative to the price of traded goods produced in

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1/ This ignores the influence of taxes and restrictions on trade. As intermediate goods have not yet been introduced into the analysis, prices of traded goods are the same as value added prices.

partner countries; this would not be an indication of an improvement in competitiveness. Similarly, a rise in the foreign currency price of traded goods produced by the home country relative to the price of foreign produced goods is not necessarily indicative of a deterioration of competitiveness to the extent it reflects a shift in demand preferences. It is also clear that, in these circumstances, one cannot infer competitiveness developments from relative unit labor cost developments alone. For example, an unchanged RER_{ULC} combined with a fall in RER_{PVT} should not be interpreted as indicating no change in the home country's competitive position; rather it suggests a squeeze in profit margins in the home country relative to partner countries. Thus, it is important to examine simultaneously the development of RER_{ULC} and RER_{PVT}, as is suggested by the final term in equation (3). In particular, a decline in RER_{ULC} relative to RER_{PVT} (i.e. in the share of labor in value added compared with partner countries) suggests that cost conditions have supported an increase in production of traded goods relative to production in partner countries. Thus, a profit based indicator of competitiveness can be defined:

$$(6) \quad RER_{PRF} = RER_{ULC}/RER_{PVT}$$

with an increase in RER_{PRF} representing a deterioration of the competitive position of the home country. This measure is the ratio of the labor share in value added in the traded goods sector of the home country relative to the same calculation for partner countries.

Turning next to how the presence of intermediate goods in the production process influences the interpretation of RER_{ULC}, it is useful to write out the cost function for (2),

$$(7) \quad \hat{P}_T = \phi_{VT} \cdot \hat{PV}_T + \phi_{IN} \cdot \hat{P}_{IN} + \phi_{IM} \cdot \hat{P}_{IM}$$

where ϕ_{VT}, ϕ_{IN}, and ϕ_{IM} are respectively the shares of value added, domestic (nontraded) intermediate inputs, and imported intermediate inputs in the total value of traded goods output, and one now has to distinguish between the prices of output (P_T) and of value added (PV_T).

It is clear that if the traded goods sectors in two countries experience very different intermediate input cost pressures, then the RER_{ULC} measure of competitiveness may give misleading results. For example, the products of the home country might be more dependent on imported inputs than the products of partner countries. In these circumstances, with a given relative output price (P_T/P_{T*}), a sharp increase in the price of imported inputs (e.g., oil) would tend to erode the competitive position of the home country. Unless wages were reduced, profit margins in the home country would be squeezed; the weakened competitive position would be reflected in an appreciation of

RER_{PRF} but would not be identified from RER_{ULC}. 1/ The influence of intermediate goods on the interpretation of RER_{ULC} is not dependent on differences across countries in the degree to which intermediate traded inputs such as oil are used in the production of traded goods. Consider inputs of nontraded goods: developments in the relative price of such inputs can vary substantially across countries, particularly, as will be seen later, owing to variations in the pattern of productivity growth. Thus, considerations related to intermediate inputs underline the importance of examining RER_{PRF} when trying to identify whether market conditions have encouraged an increase in traded goods output in the home country relative to its partners.

c. Introducing differences in production technology

RER_{PRF} provides a good measure of how developments in profit margins compare with those in trading partners. However, the profit share may not be a reliable guide to relative profitability in terms of the rate of return on capital. In particular, a country with a faster rate of growth of unit labor costs than its competitors may nevertheless have more favorable profitability developments if the relatively rapid growth of unit labor costs is more than offset by increases in capital productivity. Leaving the issue of variation in capital stock until section II.d, the analysis focuses, here, on how differences across countries in production technologies can reduce the usefulness of RER_{PRF} as a measure of competitiveness. These technology differences can be static--related, for example, to the degree of substitutability between factors--or dynamic, reflecting different rates of technological progress across countries. They can also encompass institutional differences (e.g., in labor markets) which affect production decisions.

Looking first at "static" differences, it is evident from equations (3) and (4) that developments in output and profitability in response to changes in RER_{PRF} are dependent, inter alia, on the elasticity of substitution σ. How this affects the interpretation of measures of competitiveness can be illustrated by returning to the depreciation scenario outlined earlier (see p. 5). After the currency depreciation, output expansion along the short-run supply curve raises unit labor costs and thus erodes part, perhaps a substantial part, of the initial (or incipient) reduction in RER_{ULC} or RER_{PRF}. This erosion is a reflection of the transmission of the improvements in competitiveness to increased output. It is shown in Appendix I that, following a devaluation, the more responsive the short run supply curve, the smaller ex post is the improvement in either the unit-labor-cost or profit-

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1/ Indeed, RER_{ULC} may even fall, reflecting the relative contraction of output as producers move down their short-run supply curves (see discussion on p. 5). Furthermore, if wages in the home country were reduced so as to maintain the country's competitive position, RER_{ULC} would also incorrectly show an improvement in the competitive position.

margin-based measures of competitiveness. 1/ Thus, to the extent that the short-run elasticity of response is significantly different between countries, one cannot infer the evolution of competitiveness by examining RER_{PRF}. Consider two countries A and B facing a common world price for their output but with A having a larger short-run supply elasticity. Assume that the two countries experience the same incipient reduction in the ratio of ULC_T to PV_T, owing, for example, to an equal effective depreciation of their currencies. Ex-post, A will have a smaller reduction in the ratio of ULC_T to PV_T relative to pre-shock levels. How is this smaller improvement in profit margins in A consistent with a gain in competitiveness relative to B? Although A has experienced a smaller gain in unit profits than B, it has a larger gain in total profits as it has moved further up its supply curve, and with capital stocks unchanged, the return to capital has increased by more.

Incorporating technical progress, the short-run supply curve (3) needs to be expanded.

$$(8) \quad \hat{V}_T = \varepsilon_{AT} + \varepsilon_{KT} - \psi_{LT} \cdot \alpha_T \cdot (\hat{ULC}_T - \hat{PV}_T)$$

where ε_{AT} and ε_{KT} are respectively the rate of factor-neutral and capital-augmenting technical progress. Thus, different rates of neutral or capital augmenting technical progress across countries can limit the usefulness of RER_{PRF}. In particular, a country with relatively fast factor-neutral or capital-augmenting technical progress in the traded goods' sector, may gain competitiveness even with RER_{PRF} rising.

In understanding the influence of technical progress, it is useful to differentiate between its impact effect and the effect once firms have had a chance to adjust. On impact, technical progress reduces ULCs. However, it produces disequilibria in factor markets through two channels--first, by creating a wedge between marginal product and marginal cost and, second, by changing relative effective factor supplies (except in the case of factor-neutral progress). The adjustment to these developments in the short run (in which the capital stock is fixed) and the long run (considered in the next section) depends on the nature of technical progress, factor market conditions and product market conditions.

1/ In the case of a Cobb-Douglas production function (which reflects a rather strong supply response), there will in fact be no measured gain in competitiveness despite a large increase in output. Conversely, a fixed coefficients production function will exhibit a depreciation of RER_{ULC} and RER_{PRF} of a magnitude similar to the devaluation with no supply response, as the initial impact of the devaluation is not "eroded" by a movement up the supply curve. These cases are excluded from the present analysis, which assumes an elasticity of substitution between 0 and 1.

If technical change is capital augmenting, a fall in the capital share (i.e., a rise in the ratio of ULC_T to PV_T) is necessary to absorb the increased availability of capital services. 1/ However, in the case of labor augmenting progress a reduction in the labor share is needed to absorb the increased availability of labor services. 2/ The case of factor-neutral technical progress can best be seen as a combination of labor-augmenting and capital-augmenting forms and the outcome for the labor share is uncertain. 3/ Thus, it is clear why a separate positive term for capital-augmenting or factor-neutral technical progress appears in the supply curve specified in labor-share:output space (i.e in equation (8)). The effects of labor-augmenting technical progress,

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1/ A rise in effective capital services increases the marginal product of labor (MPL) creating a wedge between MPL and the wage rate. Higher demand for labor bids up the wage rate. The degree to which the labor share rises depends on the responsiveness of labor supply to the real wage rate--the more responsive the labor supply the smaller the increase in the labor share and the larger the increase in output.

2/ Labor-augmenting technical change boosts the effective supply of labor services per man-hour. If wage rates per man-hour grow by the same percentage, the wage cost per effective unit of labor services is unchanged and employers have no incentive to increase their employment of labor services. As a result, man-hours of labor are reduced in proportion to the rise in wages and the labor share in value added remains unchanged. To realize greater utilization of labor services (and, therefore, output gains), it is necessary that wage costs per man-hour grow by less than labor efficiency, producing a fall in the wage cost per unit of labor services. (To the extent that the output price needs to be reduced to sell the higher output, a larger fall in wages is required to achieve a given rise in output.) With an elasticity of substitution of less than 1, the increase in the utilization of labor services is less proportionately than the decline in wages costs per unit of labor services, so that the share of labor in value added declines.

3/ If wage rates per man hour and the return per unit of capital increase by similar percentage amounts the share of labor would remain unchanged. However, higher wage rates may elicit a greater supply of labor man hours putting downward pressure on the labor share. On the other hand, reduced prices necessary to sell traded goods output will increase the real product wage tending to raise the share of labor.

however, get completely absorbed in the labor share, and, thus, in RER_{PRF}. 1/

It is interesting to examine how technical change affects the rate of return on capital, assuming unchanged prices for output and intermediate goods. In the case of labor-augmenting technical progress, for a given value-added price, both unit profits and the average product of capital rise. With factor-neutral technical change, unit profits remain the same or increase and the average product of capital is higher. In both these cases, therefore, there is an unambiguous increase in the rate of return on capital. With capital-augmenting technical progress, capital productivity rises, but there are lower unit profits and the effect on the rate of return is uncertain. The higher the elasticity of substitution between capital and labor and the greater the real wage elasticity of the supply of labor, the more likely it is that the rate of return rises. 2/

d. Introducing the time dimension

The discussion up to this point has assumed an unchanged physical stock of capital and has dealt only to a limited extent with the time dimension in the interpretation of RERs. Three time frames seem to be important: (i) the short-run disequilibrium stage, (ii) the short-run equilibrium, in which labor adjusts but the capital stock is fixed, and (iii) the long-run equilibrium in which the use of all factors adjusts. Assume an unexpected depreciation which results, on impact, in a decline of ULC_T relative to PV_T in the home country. In the short-run disequilibrium stage, firms are not able to fully adjust labor use to the level desired given the available capital, and this limits the supply response. As the elasticity of supply response increases with time (as firms move to the new short-run equilibrium), the initial

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1/ A labor-augmenting productivity improvement does not shift the supply curve in labor-share:output space. For a given level of output and capital services, the firm uses the same amount of labor services before and after the productivity change (but a smaller number of man hours). For the firm to be on its supply curve, the real product wage per unit of labor services must be the same as before the productivity improvement and hence the labor share must be the same. In the case of a capital-augmenting productivity improvement, however, there is a shift in the supply curve. With the physical capital stock unchanged, the same output requires a lower input of labor services than before the productivity change. Given the elasticity of substitution of less than 1, the percentage increase in the real marginal product of labor (and the real wage) must be greater than the percentage decline in the utilization of labor services and thus, for a given output level, the labor share must have increased if the firm is on its supply curve.

2/ If labor supply is completely inelastic, the rate of return increases only if the elasticity of substitution is greater than the labor share in value added. If labor supply is infinitely elastic with respect to the real wage the rate of return to capital unambiguously rises.

decline in RER_{ULC} and RER_{PRF} will be partially offset as firms increase output by employing more labor; it would clearly be inappropriate to infer a deterioration of competitiveness from this second phase when RER_{ULC} and RER_{PRF} are rising. When one moves to a time frame sufficiently long for capital to be variable, the boost to the rate of return in the traded goods sector that occurred during the first two time frames will be moderated as capital moves into the sector. This will increase the labor share of value added, i.e., ULC_T will rise relative to PV_T. Thus, in this third time frame, assuming there have been no changes in cost or price conditions in competitor countries, RER_{PRF} will indicate a deterioration of competitiveness, rather in contradiction with the expansion of output associated with the influx of capital into the traded goods sector. 1/

Following the same logic as in the previous paragraph, an increase in the profit share of value added could reflect a decline in the capital stock as a reaction to an earlier deterioration in the competitive position. In still other circumstances, there might be a retrenchment in the capital stock after a favorable productivity shock. Consider a capital-augmenting productivity improvement which reduces the rate of return on capital. 2/ If the required rate of return on capital (influenced by the world real rate of interest or profitability in the nontraded goods sector) is unchanged, then, in a time frame when capital is mobile, capital will be withdrawn from the traded goods sector, putting upward pressure on the rate of return and the profit share.

One can also imagine a reduction in the capital stock which has little to do with profitability developments in the traded goods' sector. It could, for example, reflect an increase in the rate of return required by investors because of changes in tax laws. An increase in the rate of return in the traded goods sector could also be a response to an independent increase in the rate of return in the nontraded-goods sector. The rate of return in the traded goods sector would rise as capital was shifted to the nontraded-goods' sector and rates of return were equalized across sectors. In both these cases, the

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1/ As an extreme scenario, consider a small country with a constant required return on capital (due for example to a fixed real world rate of interest) and a given price for its output on world markets. Assume this country experiences a positive productivity shock of a labor-augmenting kind. The long-term result will be that the capital stock will increase in proportion to the increase in effective labor services, which, assuming that the supply of man-hours is completely inelastic with respect to the real wage, will be the same as that resulting from the productivity shock. There will be no change in the labor share in value added, comparing the pre-shock level with the level after full adjustment of the capital stock. Although there will be no measured improvement in competitive position comparing the pre-shock situation with the final equilibrium, output will have increased relative to trading partners.

2/ See p. 11 for conditions under which this might occur.

increase in the rate of return in the traded-goods sector would be accompanied by a relative decline in output. Nevertheless, an improvement in competitiveness might be incorrectly inferred on the basis of RER_{PRF}.

2. Measures based on aggregate price indices

The discussion in Section II.1 has focused on RER_{ULC}, and its interaction with RER_{PVT}, as an indicator of relative profitability conditions in the traded goods sector of the home country vis-à-vis the same sector in partner countries. However an obvious question is whether the nontraded goods' sector can be left out of the analysis. The discussion in the last paragraph of Section II.1 suggests it is not appropriate to do so. Thus, in judging competitiveness, one needs to pay attention to indicators of internal resource pulls in an economy. The standard way of doing this is to use competitiveness indicators based on aggregate price indices; 1/ in this paper the focus is on a measure of the RER based on GDP deflators: 2/

$$(9) \quad RER_{GDP} = (PV_{GDP}/PV_{GDP*}).NER$$

where the aggregate value added deflator is a geometric average of the value added deflators in the traded and nontraded sectors:

$$(10) \quad \log(PV_{GDP}) = t.\log(PV_T) + (1-t).\log(PV_N)$$

Starting with the short-run time frame and assuming homogenous traded goods and the absence of technical progress, a competitiveness indicator based on aggregate price indices would indicate whether resource pulls toward the nontraded sector are stronger in the home country or in its trading partners.

Once one relaxes the assumption of homogeneous products in international trade, RER_{GDP} is insufficient on its own as an indicator of internal resource pulls across countries; one needs to use RER_{GDP} in conjunction with RER_{PVT}. If RER_{GDP} depreciates less or appreciates more than RER_{PVT}, then one can infer that PV_N is increasing faster relative to PV_T than in trading partners. 3/ This in turn might be taken to imply that resource pulls towards the nontraded sector are stronger than

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1/ Lipschitz (1979) contains a discussion of the theoretical basis for using an aggregate price index as a measure of competitiveness.

2/ In principle, a CPI based measure should give similar results in the absence of major changes in the external terms of trade. Here, the GDP deflator is used, as it is more closely linked to the allocation of resources.

3/ Strictly speaking this requires that the shares of traded and nontraded goods [t and (1-t)] are similar at home and abroad.

in trading partners. 1/ It is also interesting to note that one cannot infer anything directly by comparing RER_{GDP} with RER_{ULC}, as the relationship between ULC_T and PV_T may diverge in the home country from what is happening in partner countries.

However, the valid use of aggregate price indices as a measure of internal resource pulls is crucially dependent on the pattern of productivity developments in the home country vis-à-vis partner countries. To see this one can look at the cost functions for value added in the traded and nontraded goods sectors:

$$(11A)\quad \hat{PV}_T = \phi_{LT}\cdot\hat{w}_T + \phi_{KT}\cdot\hat{r}_T - \phi_{LT}\cdot\varepsilon_{LT} - \phi_{KT}\cdot\varepsilon_{KT} - \varepsilon_{AT}$$

$$(11B)\quad \hat{PV}_N = \phi_{LN}\cdot\hat{w}_N + \phi_{KN}\cdot\hat{r}_N - \phi_{LN}\cdot\varepsilon_{LN} - \phi_{KN}\cdot\varepsilon_{KN} - \varepsilon_{AN}$$

Clearly, with different rates of technical progress in the two sectors, one cannot infer the relative evolution of factor rewards from prices. Thus in making judgments about the signals being provided to suppliers of factor services, it is necessary to adjust developments in the internal terms of trade for differences in the rate of productivity growth in the traded and nontraded-goods sectors. As can be seen from (11A) and (11B), this can, in principle, be done by multiplying sector value added price indices by indices of sectoral productivity and with these adjusted sectoral deflators produce a new relative price variable $(PV_T/PV_N)_{ADJ}$. 2/ If $(PV_T/PV_N)_{ADJ}$ increases, this would seem to indicate that the return to capital is rising in the traded-goods' sector relative to the nontraded sector thus pulling resources into the traded sector. 3/

The problem in making such an adjustment, however, lies in measuring the "ε" variables. The most practical way of measuring productivity developments is by calculating the rate of change of the average product of labor. Such a measure may be distorted however by changes in sectoral capital:labor ratios. This can be seen from the

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1/ The magnitude of resource flows will however depend on parameters of the production functions in the two sectors at home and in trading partners. The fact that relative prices indicate a stronger resource pull in the home country does not mean that actual resource flows will be larger in the home country; if production functions in the home country exhibit relatively low elasticities of substitution, then actual resource flows from traded to nontraded sectors could be smaller than in partner countries despite an apparently larger price incentive.

2/ Multiplying sectoral value added price indices by sectoral productivity indices is equivalent to moving the "ε" terms from the right hand side of equation (11A) and (11B) to the left hand side.

3/ However, one cannot say this unambiguously unless labor and capital shares are similar in the two sectors. One also has to assume that labor markets are effectively integrated. To the extent that wage increases are different across sectors, then one may not be able to compare the development of r across sectors from PV_N and PV_T.

expression for the rate of growth of labor productivity which can be written as follows:

$$(12) \quad \hat{Q}_i - \hat{L}_i = \varepsilon_{Ai} + \phi_{Li} \cdot \varepsilon_{Li} + \phi_{Ki} \cdot \varepsilon_{Ki} + \phi_K \cdot (\hat{K}_i - \hat{L}_i)$$

$$\text{for } i = N,T$$

Thus, for example, if more rapid technical progress in the traded sector is reflected in faster wage growth and the nontraded sector tries to match these increases, then the capital:labor ratio is likely to rise at a faster pace in the nontraded sector. In such a circumstance, an indicator which adjusts relative price development for changes in labor productivity is likely to exaggerate the underlying rate of productivity growth in the nontraded sector relative to the traded sector.

Leaving aside this measurement issue, how should one interpret changes in the relative price of traded and nontraded goods adjusted for differences in sectoral productivity developments? If, for example, the adjusted relative price measure $(PV_T/PV_N)_{ADJ}$ shows no change over time and a similar situation persists in trading partners, does this mean that there has been little change in traded goods competitiveness?

Consider first the case where rigidities in factor markets allow different rates of growth of nominal wages across sectors; a comparison of value added prices is not sufficient to infer relative developments in the return to capital. Next, consider the case where the rate of technical progress is faster in the traded goods sector than in the traded goods sectors of partner countries. If factor returns do not encourage reallocation of resources either at home or abroad, there will be faster growth of traded-goods output than in partner countries. In such circumstance, a constant $(PV_T/PV_N)_{ADJ}$ is not an indication of unchanged relative competitive positions. Moreover, if technical advance is significantly more swift in the traded-goods sector of the home country than in the nontraded-goods sector, it would not be surprising if market forces encouraged some reallocation of factors away from the traded-goods sector to the nontraded-goods sector to ensure a more balanced growth in the availability to consumers of traded and nontraded goods. Thus, a decline in $(PV_T/PV_N)_{ADJ}$ could be quite consistent with traded-goods output growing faster than in partner countries, if productivity growth in the traded sector is sufficiently faster than in partner countries.

Turning to the longer run, when capital is mobile, just as was the case with unit labor cost based measures, indicators based on aggregate price developments become less useful. This can be easily explained by reference to (11A) and (11B). Within the time frame that capital is mobile, one would expect factor rewards to be equalized across sectors and thus differences in the evolution of PV_N and PV_T would reflect sectoral variation in productivity developments and factor shares. Indeed, as was the case with the RER_{ULC} based measure, changes in RER_{GDP}

or $(PV_T/PV_N)_{ADJ}$ induced by reallocation of capital can give very misleading indications as to the direction of resources pulls. 1/

III. Some Numerical Illustrations

To illustrate the issues raised in Section II, this section analyses the evolution of the competitive position of the FRG vis-à-vis its principal ERM partners from the inception of the EMS in 1979 to 1988, supplementing the conventional indicators of competitiveness-- RER_{ULC} and RER_{GDP}-- with RER_{PRF} and information on developments in output, productivity and the internal terms of trade. 2/

It should be emphasized that much of the analysis must be interpretative; a number of important factors identified in section II are difficult to measure. One such example is the exogenous rate of productivity growth. 3/ While average labor product can easily be calculated, this is influenced by changes in the capital:labor ratio; a more appropriate indicator of productivity would require data on capital stocks disaggregated by sector which are not readily available for most countries. It is also difficult to adjust labor productivity growth for differences across sectors in the evolution of hours worked per employee. Even more problematic is determining the distribution of exogenous productivity growth between factor-neutral, labor-augmenting and capital-augmenting forms. It should be noted that the concept of productivity relevant in the present context is broad, encompassing much more than technological factors; productivity growth resulting from changes in work practices has, in principal, identical implications for output and profitability as technological changes which have the same effects on effective factor supplies. For example, pure labor dishoarding is essentially the same as labor-augmenting technological change.

A second problem is that measures of competitiveness are affected by an economy's response to changes in its competitive position, as firms move along their short-run supply schedules or, in a longer time frame, as they adjust capital stocks. This gives rise to a difficult interpretative question: Are the changes in RERs that occur in any short-term period a reflection of new developments in the competitive position of a country or are they the result of the economy's longer-term response to competitive developments in preceding years? It is virtually impossible to deal with this problem in a theoretically

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1/ The effect of capital reallocation in response to a change in the productivity adjusted internal terms of trade is to offset, at least in part, the original change in this terms of trade.

2/ The analysis focuses on Belgium, Denmark, France, Italy and the Netherlands. The 1988 cut-off point was for data reasons; comprehensive 1989 data were not available for all the countries when the calculations were made.

3/ The term "exogenous" is used here to mean that the productivity growth is not the result of changes in the capital:labor ratio.

rigorous fashion. 1/ The approach adopted here is to analyze the data as if the movements from one time frame to another have not affected the evolution of the indices. This is a pragmatic response to the difficulties raised above with little theoretical basis. However, as an independent check on the inferences made, data are provided on output; when actual developments in market shares do not fit with the evolution of competitiveness indicators, there is some speculation as to the possible reasons.

The choice of base period for the analysis seemed appropriate given the importance that has been attached to competitiveness developments within the ERM. In analyzing developments, one should recognize that interpretations can be influenced by the choice of base period and by delays in the response of economic agents to changes in their environment. One should also bear in mind that year-to-year movements can be affected by relative cyclical positions, though presumably this is less a problem within Europe than for the group of industrial countries as a whole. 2/ More generally, inferences about competitiveness based on the indicators analyzed here are crucially dependent on the assumption of similarities across countries in production technologies, interpreted broadly to include institutional factors (including enterprise goals) affecting factor use and productivity. Clearly, this is a rather strong assumption; differences are particularly likely in the short run but permanent differences are also quite plausible.

Finally, there is the question of what products one classifies as traded goods. In this paper, the traded goods sector is defined, rather narrowly, as manufacturing. This has been the standard approach in the design of indices of the RER, such as those produced by the Fund. It also has the virtue of enabling one to evade the difficulty of dividing other goods and services into traded and nontraded components. Clearly, however, it leaves out some important traded activities. Moreover, given the breadth of envisaged market integration in Europe in the 1990s, a broader focus will become increasingly necessary.

With these various caveats in mind, the theoretical considerations of section II may now be applied to the data. Two sets of data are used--the first relates to the bilateral relationship between Italy and

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1/ Some attempt might be made through the analysis of sectoral capital stocks; however, the availability of data to pursue such an analysis is limited for most countries.

2/ The Fund does publish measures of RER_{ULC} adjusted and unadjusted for relative cyclical positions. However, to carry out cyclical adjustments for the wide range of indicators used here would have been a major exercise which would have contributed little to the central purpose of the study.

the FRG and the second to the competitiveness of the non-German ERM countries as a group against the FRG--and four standard charts are presented for each data set. The bilateral analysis has also been done for Belgium, Denmark, France and the Netherlands, but the case of Italy was chosen as the richest illustration of the conceptual difficulties in measuring competitiveness. 1/

1. The Federal Republic of Germany and Italy

The bilateral analysis of Italy and the FRG provides a good example of how inconsistencies can arise between the conventional measures of competitiveness and actual output developments. For most of the period under review, although Italy appears to have gained market shares relative to the FRG, the conventional indicators show an erosion of competitiveness vis-à-vis the FRG.

The first chart (Chart 2) shows bilateral real exchange rate indices for Italy against the FRG. 2/ Various definitions of the real exchange rate (i.e., RER_{ULC}, RER_{PVT}, RER_{PRF}, and RER_{GDP}) are presented and the data are indexed with 1979 at 100. The conventional indices show, relative to the late 1970s, a real appreciation of the lira for most of the period under review; but while the measure based on unit labor costs suggests that there was some erosion of manufacturing competitiveness that was subsequently recouped, that based on GDP deflators shows a much larger sustained deterioration. As it turns out, these inferences are almost certainly false.

For the manufacturing sector it is clear from Chart 2 alone that RER_{ULC} is a misleading indicator. While for most of the period under review the lira was appreciated in real terms based on unit labor costs in manufacturing compared with the late 1970s, the index based on value added deflators in manufacturing was even more appreciated. As a result the profit margins in Italian manufacturing rose relative to those in the FRG and this is reflected in the real depreciation of the RER_{PRF} index.

The inference from RER_{PRF} that the competitive position of the Italian manufacturing sector improved vis-à-vis the FRG is reinforced by Chart 3, which presents information on output and productivity developments in the two countries. The top panel shows manufacturing production rising more rapidly in Italy than in the FRG, and the discrepancy holds when manufacturing production in each country is

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1/ The examination of bilateral rates comes not from any belief that such rates are in themselves of importance; rather it was felt that the varied factors which impinge on the interpretation of RERs could be most effectively understood by analyzing bilateral rates. The bilateral analysis for countries other than Italy was included in an earlier version of the paper and is available from the authors upon request.

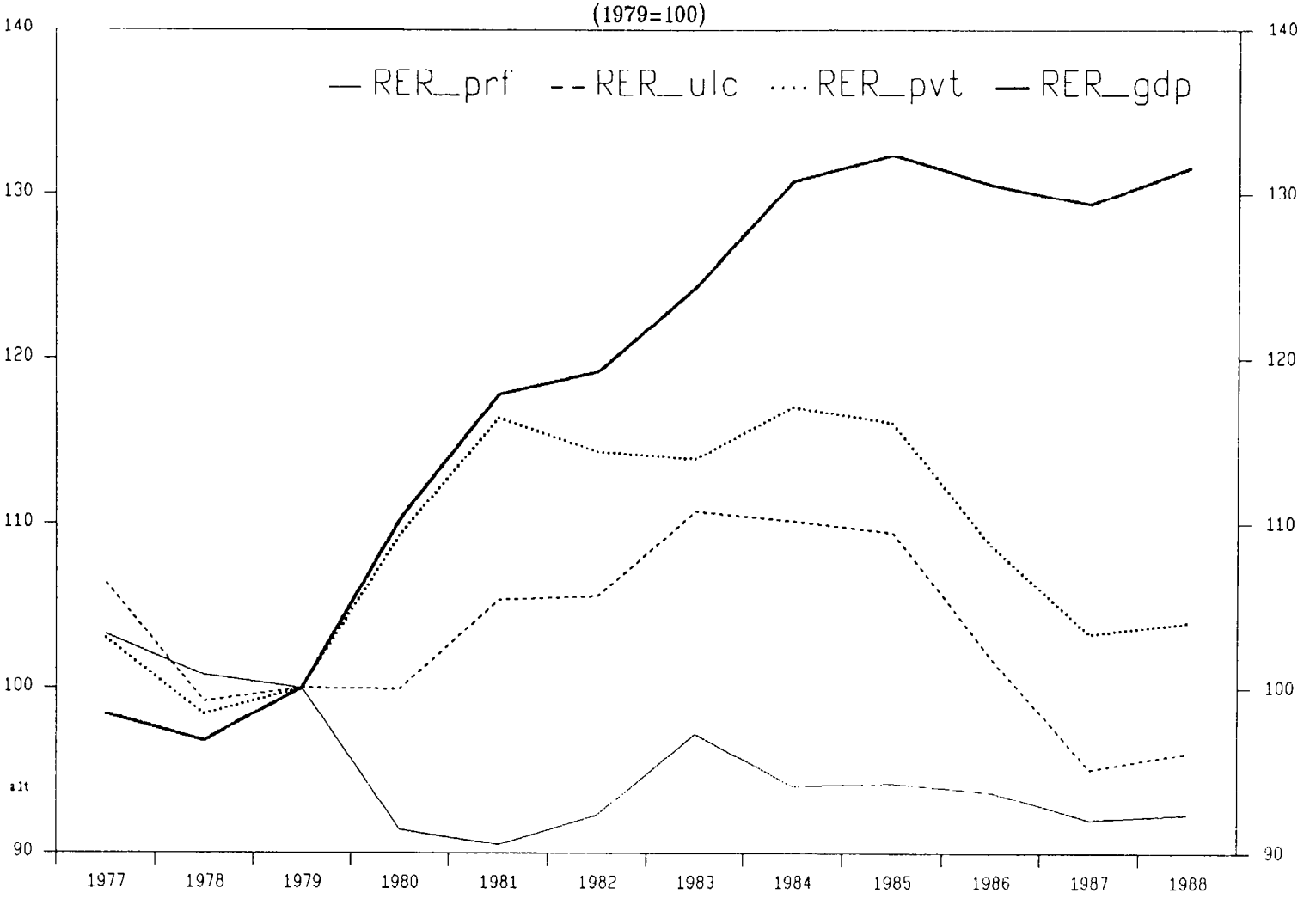
2/ Variables are defined such that an increase in RER indicates a real appreciation of the lira against the deutsche mark.

Chart 2

Italy and Germany

Real Exchange Rates 1/

(1979=100)

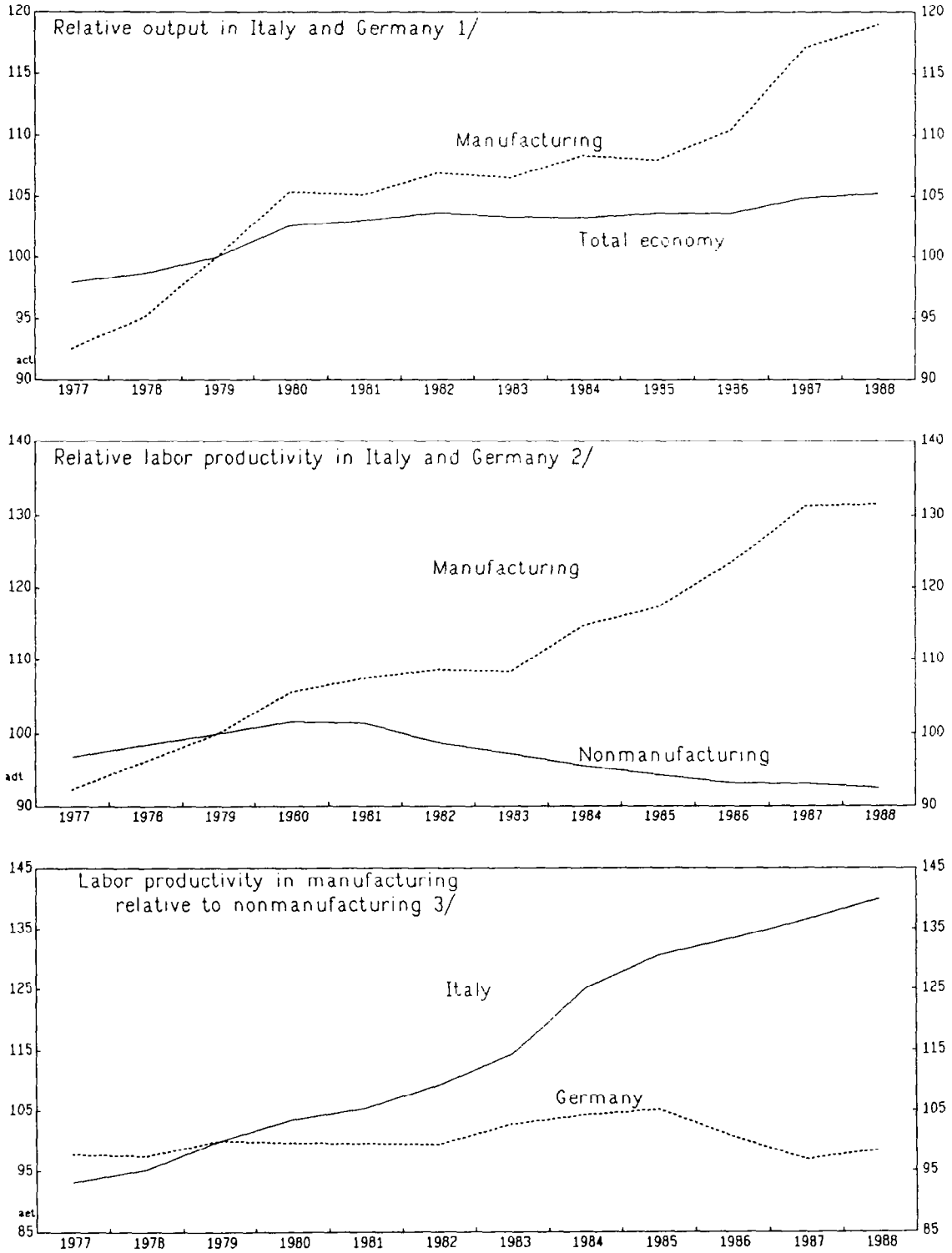


Sources: See Appendix II

1/ Bilateral rates between Italy and Germany. An increase indicates a real appreciation for Italy.

Chart 3

Italy and Germany
Output and Productivity Developments
(1979=100)



Sources: See Appendix II.

1/ Value added in constant prices; data for Italy divided by data for Germany.

2/ Productivity in Italy divided by productivity in Germany.

3/ Manufacturing productivity divided by nonmanufacturing productivity.

scaled by GDP. 1/ Improving relative profit margins in Italy were probably not the only factor boosting its market shares. The second panel shows, for both manufacturing and nonmanufacturing sectors, the ratio of average labor product in Italy relative to that in the FRG. It is clear that labor productivity in manufacturing rose at a markedly faster rate in Italy than in the FRG. To the extent that this reflected capital-augmenting or factor-neutral productivity gains for Italian industry, one would have expected an increase in Italy's market shares independent of developments in RER_{PRF}. The third panel uses the same information to contrast sectoral productivity differences within each country; these are more marked for Italy than for the FRG and this has implications for analyzing developments in the internal terms of trade.

An analytic presentation on the internal terms of trade is given in Chart 4. In the top panel, the ratio (PV_T/PV_N) is shown for Italy and the FRG. In the middle panel, these ratios are shown adjusted for differences in the growth of labor productivity between sectors. 2/ The bottom panel is identical to the middle panel except that it focusses only on business activity (it excludes government from the nontraded sector). Government activity is excluded not because it exercises no influence on factor allocation in the rest of the economy, but rather because factor returns in the government sector are likely to have a more limited influence on resource flows: entry into the sector is limited and, in general, is unrelated to profit-maximizing considerations. Also, longer-term employment relationships may render factors less mobile out of this sector.

Chart 4 helps explain the large discrepancy between the measure of the real exchange rate based on unit labor costs in manufacturing and that based on GDP deflators (Chart 2). Clearly the much larger appreciation of the lira in terms of RER_{GDP} reflects the rapid increase in the relative price of nonmanufactures in Italy. 3/ This is a straightforward intuitive result--that is, a shift in the internal terms of trade would generally be inferred from such a discrepancy between the two indices of the real exchange rate.

Inferences about the implications of such a shift in the internal terms of trade for resource allocation are, however, much more difficult, and it is to this question that the second and third panels of Chart 4 are addressed. From these panels it is clear that the drop in the relative price of manufactures in Italy (compared with the FRG) is more than accounted for by developments in the sectoral pattern of

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1/ Normalizing by relative GDP growth rates helps take into account the likelihood that producers in each country have a large share in their home market.

2/ As noted, these adjusted data should be interpreted carefully as they do not control for differences in productivity growth due to changes in capital:labor ratios.

3/ A second factor contributing to the larger appreciation of RER_{GDP} than RER_{ULC} is the widening of profit margins in Italian manufacturing relative to the FRG.

productivity. In the manufacturing sector, productivity in Italy rose much more rapidly than in the FRG while in the nonmanufacturing sector productivity increased less rapidly than in the FRG. Thus, when one adjusts relative prices for productivity developments, it appears that developments in the internal terms of trade in Italy relative to the FRG did not constitute a competitive disadvantage for Italian manufacturing; consequently, it did not set up forces whereby (relative to the FRG) resources were pulled out of manufacturing into other more profitable sectors. If one ignores these developments in productivity and instead makes the "neutral" assumption of no change in the sectoral pattern of productivity, one is led to an incorrect inference about intersectoral resource flows and competitiveness.

The analysis above has focused on intersectoral resource pulls in Italy relative to the FRG and not on the specific nature of resource shifts in each country. In Italy, for example, with the large differences in labor productivity growth across sectors, the pace of output growth in the manufacturing sector in Italy relative to the nonmanufacturing sector has been moderated by a reallocation of labor in relative terms toward the nontraded sector (Chart 5). What is striking from Chart 5, however, is that the relative decline in the employment share of Italian manufacturing was greater than in the FRG. Given the stronger productivity growth in manufacturing in Italy than in the FRG, this was not inconsistent with a strengthening of Italy's competitive position. Nevertheless, it does seem at odds with the inference from Chart 4 that resource pulls toward the nontraded sector were less strong in Italy than in the FRG.

A number of factors may help reconcile these observations. First, Chart 5 is an incomplete representation of the allocation of resources as it illustrates only the allocation of labor. Second, the adjustment of relative prices for productivity movements may be contaminated by shifts in capital:labor ratios. Third, timing problems may distort the interpretation of relative price movements: over a period of eight years it is impossible to separate out relative price movements that reflect the need for resource shifts and those that reflect the outcome of resource shifts. Finally, technology differences (broadly interpreted to incorporate institutional factors) between Italy and the FRG may be sufficiently large that one cannot infer the pressure for resource reallocation simply by referring to price and cost movements in the two countries, i.e., the degree of resource reallocation encouraged by a given change in relative prices may be very different in two countries.

2. The Federal Republic of Germany and its ERM partners

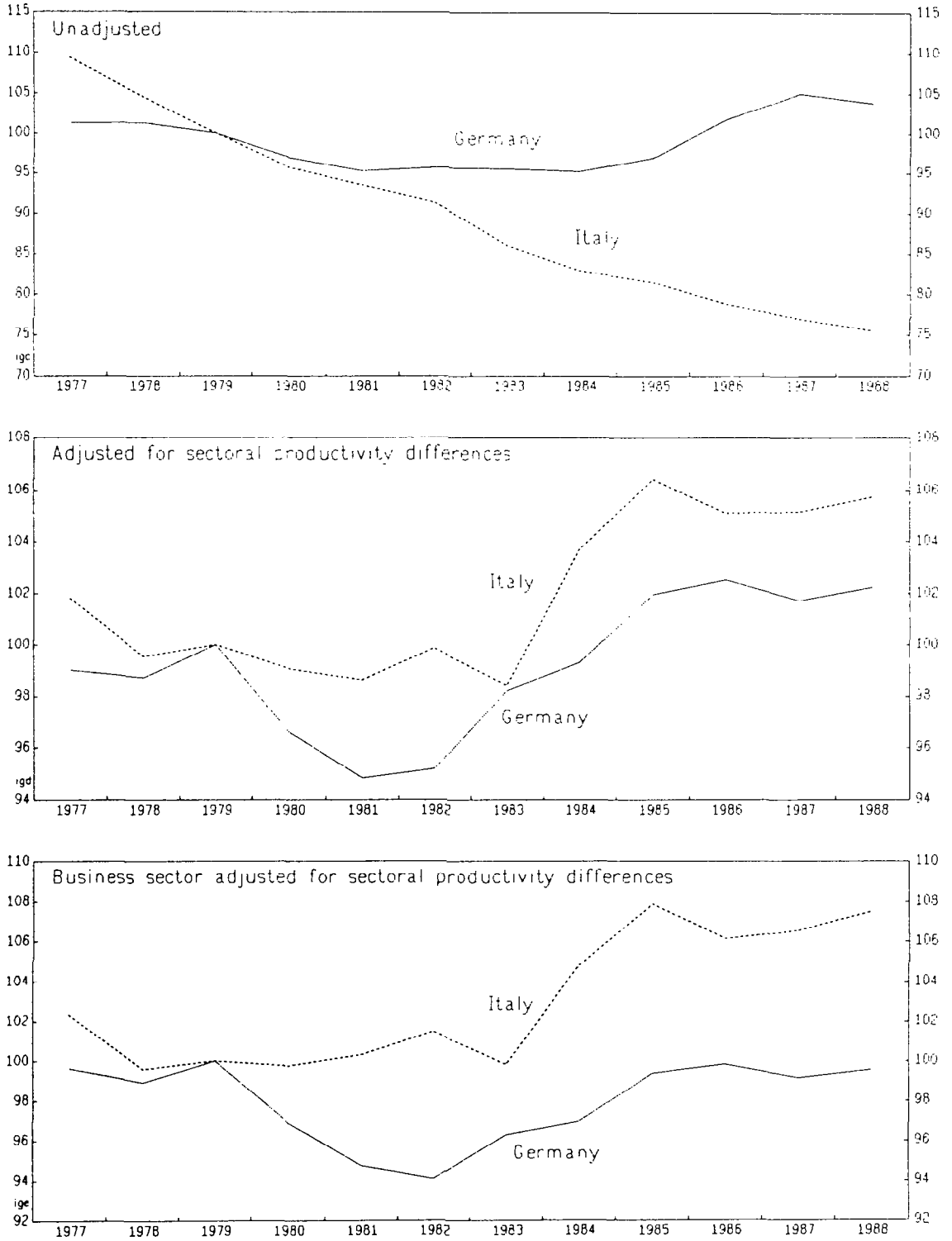
A similar set of four charts is used to assess the competitive position of the FRG against its ERM partners as a group. Chart 6 shows the weighted average RERs of the FRG vis-à-vis five ERM partner

Chart 4

Italy and Germany

Relative Prices of Manufactured and Nonmanufactured Goods 1/

(1979=100)

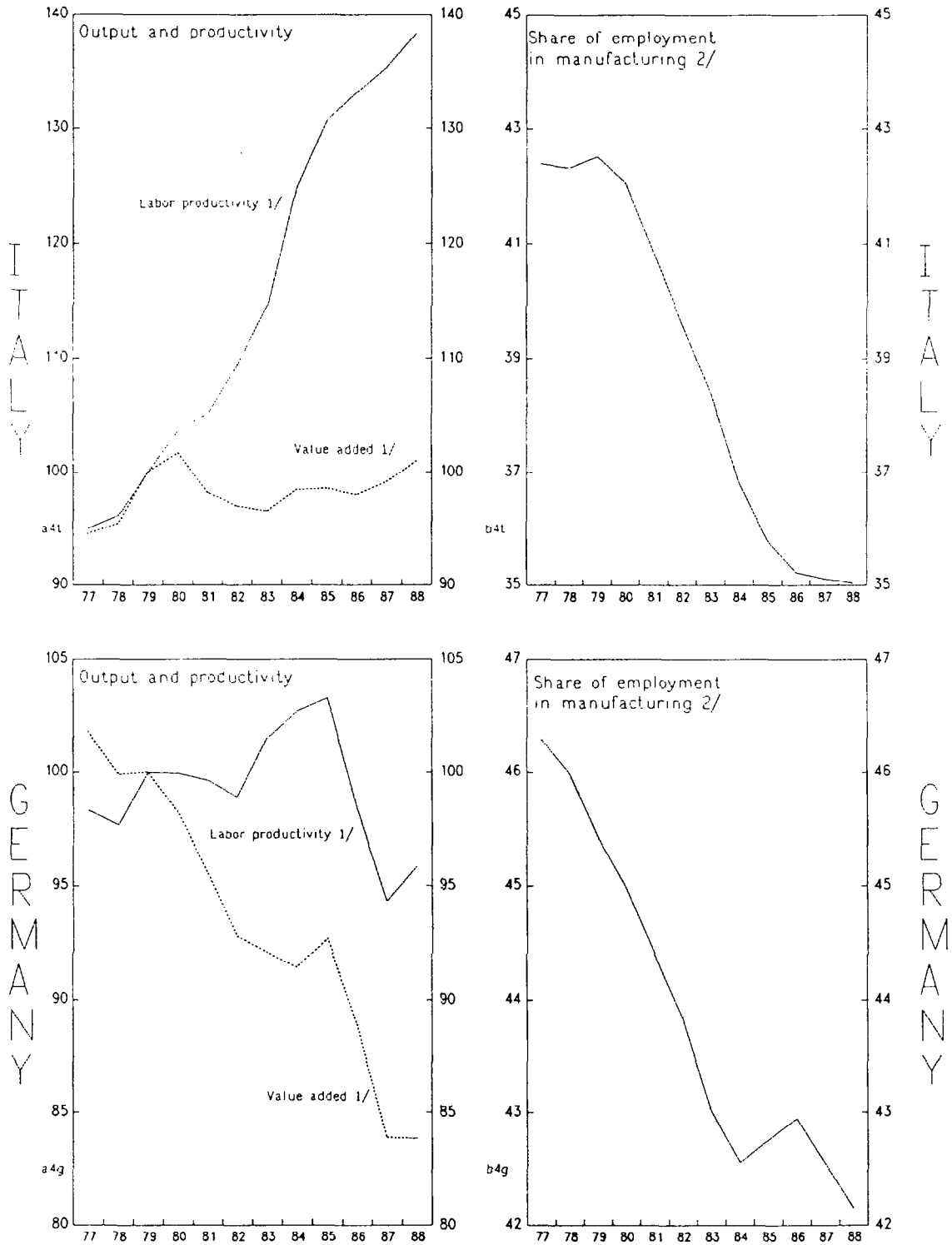


Sources: See Appendix II.

1/ Price of value added in manufacturing relative to the price in nonmanufacturing.

Chart 5

Italy and Germany
Developments in Output, Productivity, and Employment
Manufacturing Relative to Nonmanufacturing Businesses



Sources: See Appendix II.

1/ Manufacturing relative to nonmanufacturing business, 1979=100.

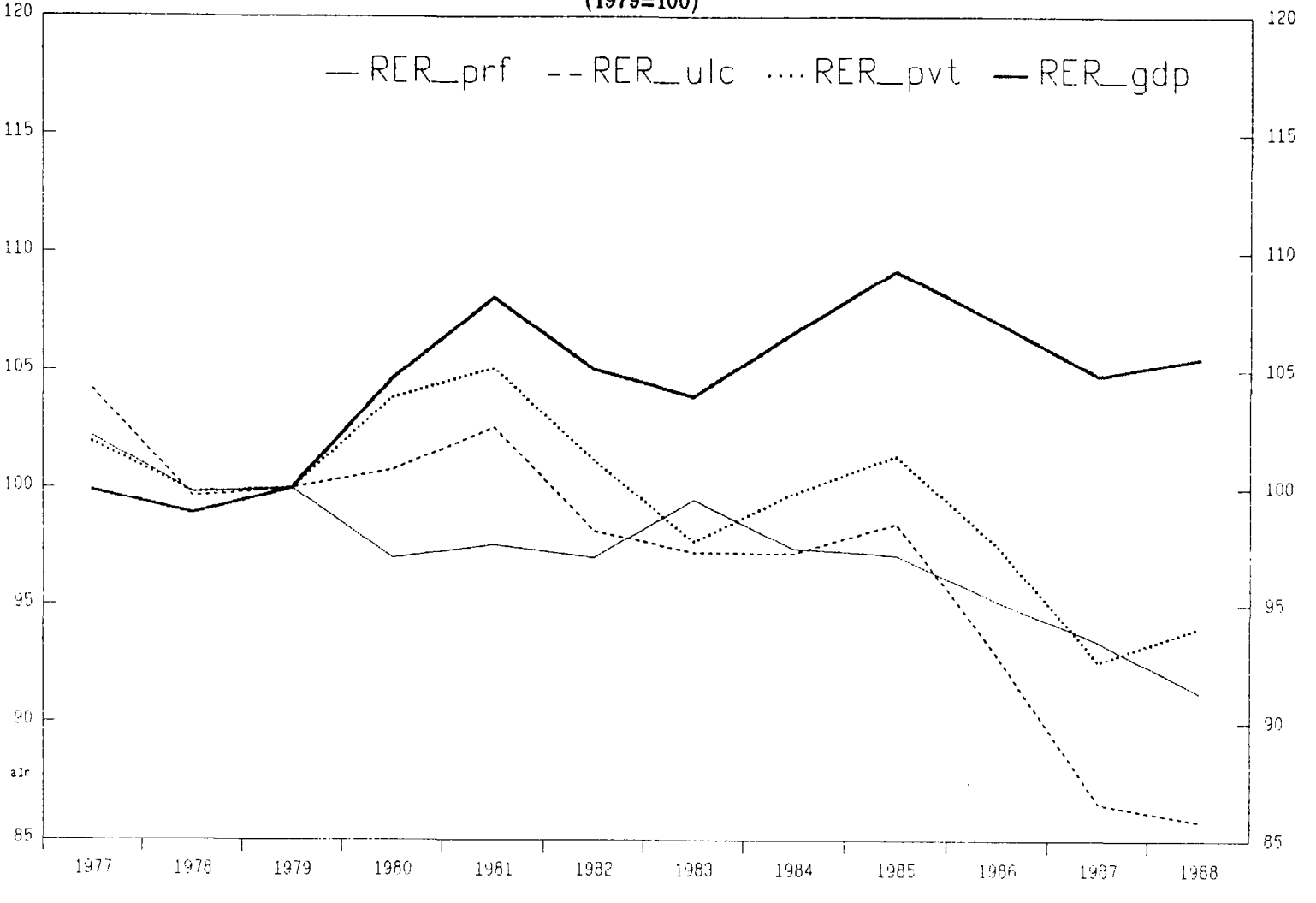
2/ Manufacturing employment in percent of total business employment.

Chart 6

ERM and Germany

Real Exchange Rates 1/

(1979=100)



Sources: See Appendix II.

1/ Effective rates for other ERM countries against Germany. An increase indicates a real appreciation for the other ERM countries.

countries: 1/ between the inception of the EMS and 1988, indicators focussing on manufacturing profitability pointed to a gain in the competitiveness of the ERM partners vis-à-vis the FRG, but the aggregate price based measure showed that these countries appreciated against the FRG. The former set of indicators seems to have been more reliable as the ERM partner countries gained market share vis-à-vis the FRG over this period (Chart 7).

The gain in market share for the non-German ERM countries would seem to reflect two factors: an increase in profit margins compared with the FRG and faster growth in the average product of labor. It is notable that relative output gains for the non-German ERM countries took place principally in 1980-82 and 1986-87--the periods in which the depreciation of RER_{PRF} and relative productivity gains were concentrated. In contrast, the stability of RER_{PRF} between 1982 and 1985 and the slower rate of productivity increase compared with the FRG were accompanied by some fall back in market share. RER_{PRF} was clearly a better guide than RER_{ULC} to developments in competitiveness over the period 1979-85. First, in 1980-81, RER_{ULC} suggested a loss in relative profitability for the non-German ERM countries, when in fact faster labor cost growth was more than compensated for by movements in value-added prices. Second, the sharp depreciation in terms of RER_{ULC} in 1986-87 significantly overstated the gains in the competitive position of the other ERM countries vis-à-vis the FRG. One clue as to why the effect of the sharp depreciation of RER_{ULC} was moderated may lie in the differential impact across countries of reduced prices of internationally traded raw materials. 2/

The more rapid rise in the relative price of nonmanufactured goods in the FRG's ERM partners, which is evident from developments in RER_{GDP} and RER_{PVT}, is shown in the top panel of Chart 8. However, when prices are adjusted for differential growth rates of productivity across sectors, one sees that this pattern is reversed: internal relative price developments were more favorable to the manufacturing sector in the other ERM countries than in the FRG. Despite this latter observation, however, the shift in labor from manufacturing to

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1/ Belgium, Denmark, France, Italy, and the Netherlands. The results would not have been materially affected by including Ireland and Luxembourg (the other members of the ERM during the period), as these two countries have relatively small weights in the FRG's external trade.

2/ Take for example the experiences of France and the FRG. Between 1985 and 1987, expressed in deutsche mark terms, the price of manufacturing production fell by 6 1/2 percent in France and by 3 3/4 percent in the FRG; the declines reflected the lower price of intermediate inputs, particularly oil, and value added deflators increased. The difference in the behavior of value-added deflators was, however, significantly greater--in deutsche mark terms, the value added deflator for manufacturing in the FRG grew by 10 1/2 percent while in France it rose by less than 1 percent. The implication is that the FRG manufacturing benefited to a greater extent from declining prices of intermediate inputs.

nonmanufacturing activities appears to have been larger in the other ERM countries (Chart 9), a development that was also observed in the bilateral comparison of Italy and the FRG.

IV. Conclusions

Given the conceptual problems involved, the empirical analysis has been interpretative and no doubt other plausible interpretations exist. Nevertheless, the combination of the empirical analysis and the theoretical discussion highlight the dangers in interpreting competitiveness indicators too literally. Some adjusted measures were used--RER_{PRF} and the internal terms of trade adjusted for productivity differences--but even these have considerable weaknesses. Additional data, for example, better information on sectoral capital stocks, could aid in the interpretation of these indicators. However, the most serious weakness seems from a practical point of view insoluble: rates of return and profit margins are endogenous and one cannot infer changes in production incentives from movements in these variables. Similarly, in interpreting measures of competitiveness, there seems from a practical point of view no way to allow for differences across countries in production technologies. Thus, there seems to be little alternative open to policymakers but to monitor a range of indices and interpret them in light of their weaknesses and in conjunction with sectoral information on actual output and employment developments.

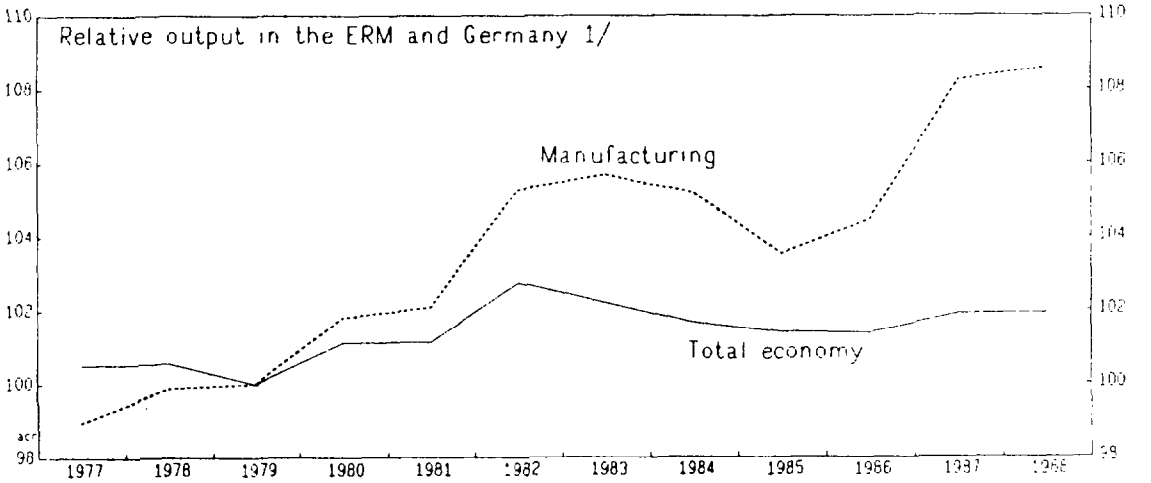
A striking feature of the analysis was the wide variation in productivity developments across countries. Not only has this made the interpretation of standard competitiveness measures extremely difficult, it also raises questions about what features of the respective economies produce these differences and how one should view these differences in connection with the further integration of the EC economies that is in prospect.

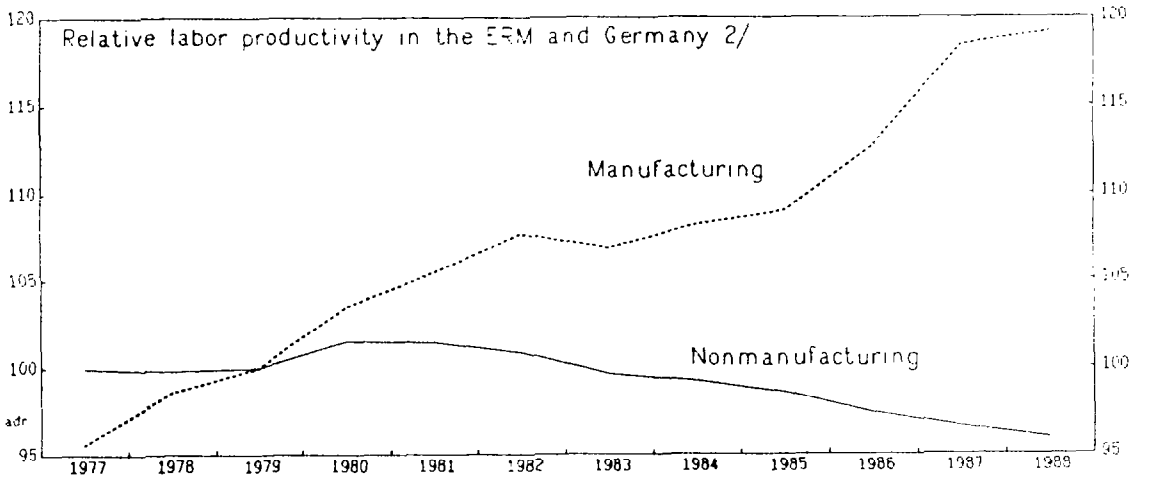
Finally, it is worth remembering that competitiveness, as defined in this paper, is not a goal in itself; the desirable evolution of the competitive position depends very much on the economic environment. For example, relatively fast growing countries need improved competitiveness to absorb faster output growth without straining the balance of payments and a deterioration of competitiveness may be appropriate for relatively slow growing countries. 1/ Similarly, a shift in demand patterns toward nontraded goods in a particular country would require a deterioration in the competitive position of the traded goods sector in that country in order to reallocate resources.

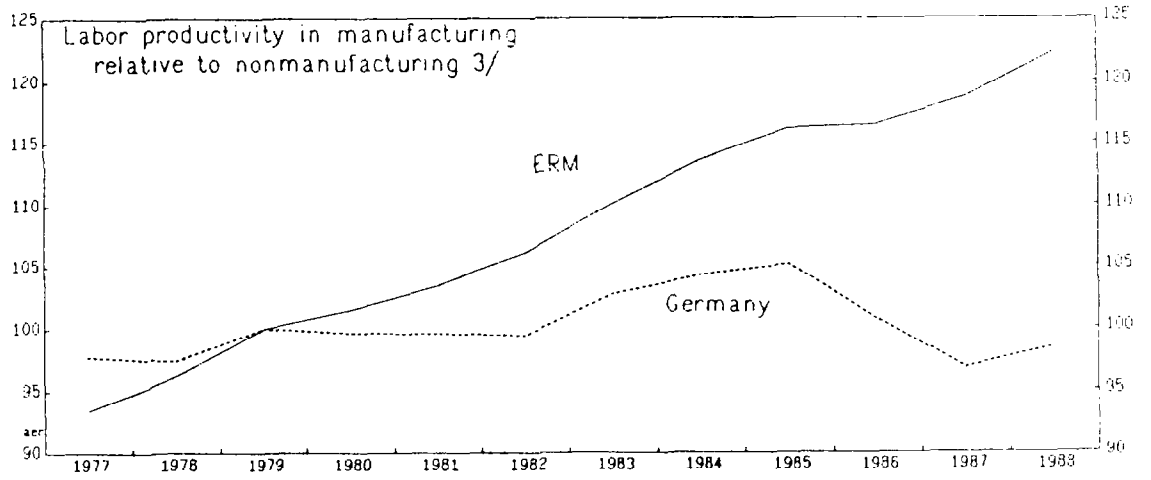
1/ This assumes traded goods produced by different countries are not perfect substitutes. This issue is analyzed further in McDonald (1988b) in the context of the question whether a regime of stable exchange rates is consistent with differences between countries in potential output growth rates.

Chart 7

ERM and Germany
Output and Productivity Developments
(1979=100)







Sources: See Appendix II.

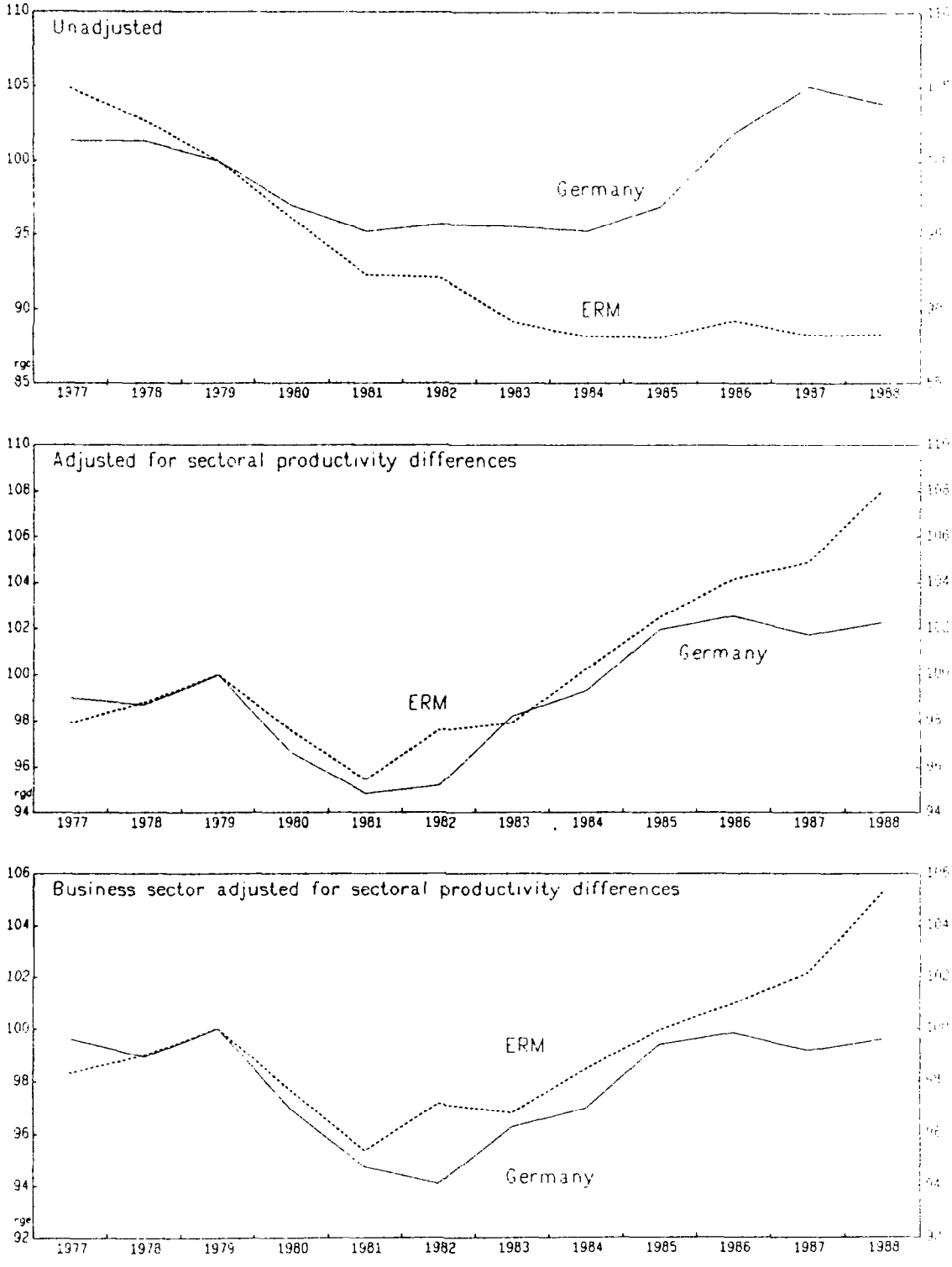
1/ Value added in constant prices; data for other ERM countries divided by data for Germany.

2/ Productivity in other ERM countries divided by productivity in Germany.

3/ Manufacturing productivity divided by nonmanufacturing productivity.

Chart 8

ERM and Germany
Relative Prices of Manufactured and Nonmanufactured Goods 1/
(1979=100)



Sources: See Appendix II.

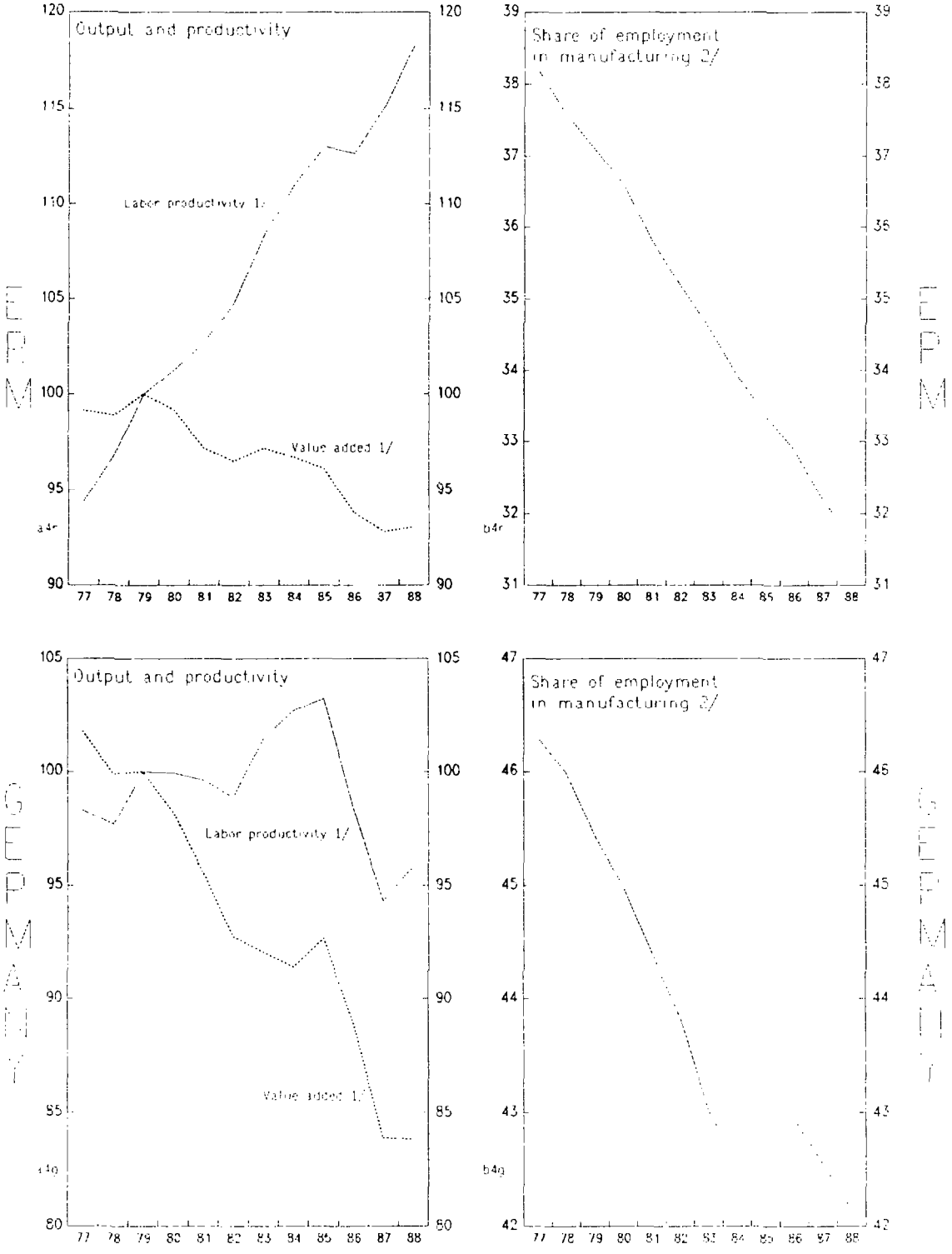
1/ Price of value added in manufacturing relative to the price in nonmanufacturing.

Chart 9

ERM and Germany

Developments in Output, Productivity, and Employment

Manufacturing Relative to Nonmanufacturing Businesses



Sources: See Appendix II.

1/ Manufacturing relative to nonmanufacturing business, 1979=100.

2/ Manufacturing employment in percent of total business employment.

APPENDIX I

Derivation of the Results for the CES Production Function

The first tier of the production function outlined in equation (2) of the text can be written,

$$A1. \quad V = \exp(\varepsilon_A \cdot t) \cdot [\rho_L \cdot \exp(-\lambda \cdot \varepsilon_L \cdot t) \cdot L^{-\lambda} + \rho_K \cdot \exp(-\lambda \cdot \varepsilon_K \cdot t) \cdot K^{-\lambda}]^{-1/\lambda}$$

where $\lambda = (1 - \sigma)/\sigma$, ρ_L and ρ_K are constants, ε_A, ε_L, and ε_K are respectively factor-neutral, capital-augmenting and labor-augmenting technical change, and K and L are the physical (as opposed to effective) quantities of capital and labor. The real marginal products of labor and capital can be derived as follows,

$$A2. \quad \frac{\partial V}{\partial L} = \rho_L \cdot \exp(-\lambda \cdot \varepsilon_A \cdot t) \cdot \exp(-\lambda \cdot \varepsilon_L \cdot t) \cdot (V/L)^{1+\lambda}$$

$$A3. \quad \frac{\partial V}{\partial K} = \rho_K \cdot \exp(-\lambda \cdot \varepsilon_A \cdot t) \cdot \exp(-\lambda \cdot \varepsilon_K \cdot t) \cdot (V/K)^{1+\lambda}$$

Setting A.3 and A.4 equal to the real wage (w/PV) and the real cost of capital (r/PV) respectively leads to demand functions for labor and capital,

$$A4. \quad (L/V) = \rho_L^{\sigma} \cdot \exp[\varepsilon_A \cdot (\sigma-1) \cdot t] \cdot \exp[\varepsilon_L \cdot (\sigma-1) \cdot t] \cdot (W/PV)^{-\sigma}$$

$$A5. \quad (K/V) = \rho_K^{\sigma} \cdot \exp[\varepsilon_A \cdot (\sigma-1) \cdot t] \cdot \exp[\varepsilon_K \cdot (\sigma-1) \cdot t] \cdot (r/PV)^{-\sigma}$$

using the substitutions: $(1 + \lambda) = (1/\sigma)$ and $(-\lambda/1+\lambda) = (\sigma-1)$.

From A.1, the short run supply function can be written:

$$A6. \quad \hat{V} = \varepsilon_A + \phi_L \cdot (\varepsilon_L + \hat{L}) + \phi_K \cdot \varepsilon_K$$

where ϕ_L and ϕ_K are the shares of capital and labor in value added. Using A.4, this can be rewritten:

$$A7. \quad \hat{V} = \varepsilon_A/(1-\phi_L) + \varepsilon_K + \psi_L \cdot \varepsilon_A \cdot (\sigma-1) + \psi_L \cdot \varepsilon_L \cdot \sigma - \psi_L \cdot \sigma \cdot (\hat{W}-\hat{PV})$$

with ψ_L being defines as $\phi_L/(1-\phi_L)$.

It is also possible to express A.7 in terms of ULC. First it is necessary to rewrite A.4. Multiplying through by $(L/V)^{-\sigma}$, A.4 becomes:

$$A4a.\quad (L/V)^{1-\sigma} = \rho_L{}^{\sigma} \cdot \exp[\varepsilon_A \cdot (\sigma-1) \cdot t] \cdot \exp[\varepsilon_L \cdot (\sigma-1) \cdot t] \cdot (ULC/PV)^{-\sigma}$$

or $$A4b.\quad (L/V) = \rho_L{}^{\alpha} \cdot \exp[-\varepsilon_A \cdot t] \cdot \exp[-\varepsilon_L \cdot t] \cdot (ULC/PV)^{-\alpha}$$

where $\alpha = \sigma/(1-\sigma)$.

Substituting A.4b in A.6,

$$A7a.\quad \hat{V} = \varepsilon_A - \psi_L \cdot \alpha \cdot (\hat{ULC} - \hat{PV}) + \varepsilon_K$$

The return per unit of capital services can also be written as a function of the labor share in value added (ULC/PV). Equating (r/PV) with the right hand side of A.3 produces:

$$A8.\quad \hat{r} = \hat{PV} - \lambda \cdot \varepsilon_A - \lambda \cdot \varepsilon_K + (1 + \lambda) \cdot (\hat{V} - \hat{K})$$

Holding K constant (for the short run) and substituting from A.7a for $\hat{V}$

$$A8a.\quad \hat{r} = \hat{PV} + \varepsilon_A + \varepsilon_K - \psi_L \cdot \beta \cdot (\hat{ULC} - \hat{PV})$$

where $\beta = 1/(1-\sigma)$. With value added and the return to capital expressed in terms of the labor share, it is interesting to see what determines the distribution of income among factors.

Multiplying A.4 by (W/PV),

$$A9.\quad (ULC/PV) = \rho_L{}^{\sigma} \cdot \exp[\varepsilon_A \cdot (\sigma-1) \cdot t] \cdot \exp[\varepsilon_L \cdot (\sigma-1) \cdot t] \cdot (W/PV)^{1-\sigma}$$

Thus, (ULC/PV) is related to the real product wage. A decline in the real product wage reduces (ULC/PV), as long as the elasticity of substitution (σ) is less than one. The extent to which (ULC/PV) is reduced depends on σ. If σ is close to zero (i.e very low substitution between labor and capital), the percentage change in (ULC/PV) is close to the percentage change in the real product wage. With σ significantly greater than zero the effect on (ULC/PV) is smaller and, in the case of the Cobb-Douglas production function (σ=1) , (ULC/PV) is completely unaffected by changes in the real product wage. Thus, for a given change in the real product wage, the larger is the effect on output (i.e., the higher is σ) the smaller will be the effect of ULC/PV. That is, countries which benefit most from an improvement in competitiveness will, other things being constant, have this reflected to the least extent either in the conventional ULC measure of competitiveness (for a given value of PV) or in the profit margin based measure (ULC/PV).

Data Sources

1. The data for charts 2-9 were drawn principally from the national accounts tapes of the OECD, supplemented (as noted below in items 6 to 9) with information from other OECD sources, national accounts publications of individual countries, and the IMF Data Fund.

2. Labor productivity was measured as the ratio of real value added to dependent employment. Adjustment for changes in the length of the working week was not possible, owing to lack of data.

3. Unit labor costs in manufacturing were derived by dividing compensation of dependent employees by real value added.

4. Value added in the total economy (in charts 3 and 7) was defined as the total of value added over individual sectors before adjustment for imputed bank services.

5. The business sector was defined as all sectors excluding government.

6. For Belgium, sectoral employment data for 1987 and 1988 were no available on the OECD tapes and the Belgian national accounts publication do not contain employment data by sector. Accordingly, information from the tapes was extrapolated for 1987-88 using data from the annual OECD Economic Survey of Belgium. Neither the OECD tapes nor the Belgian national accounts publications contain information on compensation of employees by sector. The data used here were taken from the IMF Data Fund.

7. For France, data on "manufacturing" were taken from the French national accounts publications, and were calculated by excluding the energy sector (code u3) from manufacturing and mining (codes u2-u6). Sectoral data on compensation of employees were not available for the years 1987-88, either from the OECD tapes or from the national accounts publications. Compensation of employees in the manufacturing sector in 1987 and 1988 was estimated by combining data on hours worked in manufacturing from the national accounts publications with information on hourly earnings in manufacturing from the IMF's World Economic Outlook.

8. For Italy, data on "manufacturing" also include the mining sector.

9. For the Netherlands, data on real value added in manufacturing were not available on the OECD tapes. The data used here were derived from national accounts publications of the Netherlands. Charts for the Netherlands (available from the authors) were produced with the mining sector both included in and excluded from the "nontraded group" to examine the influence of the wide swings in energy prices on the internal terms of trade. The ERM charts in this paper do not exclude mining from the Netherlands data as this adjustment is of little consequence for the group of ERM countries.

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