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Competitiveness Indicators: A Theoretical and Empirical Assessment 1/

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Abstract

This paper discusses five indicators of competitiveness: real exchange rates based on consumer price indices, export unit values of manufacturing goods, the relative price of traded to nontraded goods, normalized unit labor costs in manufacturing, and the ratio of normalized unit labor costs to value-added deflators in manufacturing. It discusses how each of these measures is associated with changes in a country's balance of trade in goods and nonfactor services and examines the relationship among these indicators. It then examines the empirical performance of three of the indicators in terms of their ability to explain trade flows.

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Summary

This paper discusses five indicators of competitiveness: real exchange rates based on consumer price indices, export unit values in manufacturing, normalized unit labor costs in manufacturing, the relative price of traded to nontraded goods, and the ratio of normalized unit labor costs to value-added deflators in manufacturing. It discusses how each of these measures is associated with changes in a country's balance of trade in goods and nonfactor services, changes which are relevant for an assessment of competitiveness, and examines how each of these indicators is related to each other. The conclusion reached in this part of the paper is that each indicator of competitiveness possesses shortcomings, and that no one indicator provides an unambiguous assessment of competitiveness. In fact, reliance on competitiveness indicators should only form part of any assessment of the appropriateness of a country's exchange rate, given the many limitations inherent in the construction of these indicators. The paper suggests that competitiveness indicators should be used in conjunction with other indicators in order to obtain an assessment of competitiveness that is as complete as possible.

Given this fact, the paper examines the empirical performance of three of the indicators (real exchange rates based on consumer price indices, export unit values in manufacturing, and normalized unit labor costs in manufacturing). The empirical analysis shows that none of the indicators works well uniformly across countries. It is impossible to unequivocally recommend one indicator above all others to explain both import and export flows at all levels of aggregation in every G-7 country. Because movements in real exchange rates may be dominated by volatility in the nominal rate. Therefore, no one indicator may be elevated to the status of *the best* indicator.

From a policy point of view, the implications are clear--in examining an issue as complex as trade competitiveness, the use of competitiveness indicators should form only part of the analysis.

I. Introduction

Since the early 1980s, many industrial countries have experienced wide fluctuations in their external positions. For the United States, the current account showed a surplus of 5 billion dollars in 1981 but deteriorated by over US$170 billion dollars by 1987, only to improve to a deficit of US$8 billion in 1991. For the United Kingdom, the current account showed a surplus of US$6.6 billion in 1980, reached a surplus of US$3.7 billion in 1981, fell into a deficit of US$1.3 in 1986, and reached a deficit of US$32.6 billion in 1990. Japan began the decade of the 1980s with a current account deficit of US$10.7 billion, but by 1987 the current account showed a surplus of US$87 billion, only to fall to US$35.7 billion in 1990, but reach US$117.6 billion in 1992. 1/

These significant changes in external positions of industrial countries and the implications they have on the rest of the world economy suggest the need to examine whether a given country's exchange rate is consistent with its desired or sustainable external position. An important aspect of such an assessment of exchange rates is a judgment concerning the competitiveness of a country's external sector. It is important to have some measure or indicator of a country's international competitiveness as it affects its trade balance or external position. For this reason, it is important to measure the competitive position of a country in order to assess whether its current exchange rate is appropriate.

It is desirable to have measures or indicators of a country's international competitiveness whose movements are associated with changes in a country's balance of trade in goods and nonfactor services. Recently, attention has been focussed on the factors which determine competitiveness, and in practice, economists have constructed a number of measures which serve as indicators of a country's competitive position. A number of authors, such as Artus and Knight (1984), Durand and Giorno (1987), Lipshitz and McDonald (1991), Turner and Van 't dack (1993), and Wickham (1993) have provided a discussion of some commonly used indicators of competitiveness based on consumer price indices, export unit values of manufacturing products, and normalized unit labor costs in manufacturing. Each of these papers describes how the indicators are constructed and used in policy analysis, but the papers fail to provide a rationale for the use of each indicator based on a unified theoretical framework. Furthermore, these papers neither explain how each of the indicators of competitiveness relate to each other in a systematic fashion, nor do they provide empirical evidence regarding how these indicators can account for movements in a country's external position.

The purpose of this paper is to fill these gaps in the literature by addressing three related aspects of this topic. First, section two of the paper provides a discussion of five indicators of competitiveness: real exchange rates based on consumer price indices, export unit values, the relative price of traded goods to nontraded goods, normalized unit labor

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1/ The reasons for these shifts in current account balances are not necessarily related to the issue of competitiveness.

costs in manufacturing, and the ratio of normalized unit labor costs in manufacturing to value-added deflators. 1/ In examining each of these indicators, the criterion used to evaluate the usefulness of the indicator is how well it can be expected to explain the balance of trade in goods and nonfactor services. Second, in section three the relationships among the indicators are discussed. The third part of the paper provides a statistical analysis of the ability of three indicators (real exchange rates based on consumer price indices, export unit values, and normalized unit labor costs in manufacturing) to explain measures of trade flows, and hence the balance on trade in goods and nonfactor services, and to answer the question: Is one indicator of competitiveness uniformly "better" than another? This section describes the econometric approach used to investigate the relationship between each indicator and trade flows and offers some guidance on how to discriminate among indicators with regard to performance. We end with our results and conclusions.

II. Indicators of Competitiveness

In this section, we discuss individually the characteristics, advantages, and disadvantages of five commonly used indicators of competitiveness. We do not discuss the statistical difficulties inherent in the construction of the various indices to any great extent, but rather concentrate on the conceptual problems. 2/

General Considerations

A useful indicator of competitiveness, i.e., the real exchange rate, would have the property that movements in the indicator are associated with changes in a country balance of trade in goods and nonfactor services. This arises from the fact that in its simplest representation, the trade balance is a function of aggregate income at home Y, aggregate income in the foreign country Y^*, and relative prices. In functional form:

$$X = F\left(\frac{E\,P}{P^*}, Y^*\right) \tag{1}$$

and

$$M = F\left(\frac{E\,P}{P^*}, Y\right) \tag{2}$$

1/ Indicators based on consumer price indices, export unit values in manufacturing, and normalized unit labor costs in manufacturing are published in the International Financial Statistics. The IFS also contains indicators based on value-added deflators and wholesale prices.

2/ Interested readers are referred to Enoch (1978) and Maciejewski (1983) for discussion of this topic.

where X denotes aggregate exports, M denotes aggregate imports, E is the nominal exchange rate (foreign currency units of the domestic currency), P is the price of domestically produced goods and P^* is the price of foreign goods. In practice, there are many real exchange rates corresponding to different measures of relative prices. What equations (1) and (2) suggest is that it is useful to find an indicator whose movements are important for explaining (X - M), a country's trade balance.

Frequently, the prices of exports, imports, or both are used in the construction of real exchange rate indices, but it is unclear exactly what types of prices should be used in such indices. For example, an increasingly large proportion of the volume of international trade takes place in intermediate inputs, raw materials, and capital goods, rather than final goods. If the objective is to explain the balance of trade in goods, then it seems appropriate to obtain information on the prices of these intermediate goods and incorporate them in a real exchange rate index. A real exchange rate based on consumer price indices contains information on the prices of final consumer goods, but does not contain information on the prices of traded intermediate goods directly, so this type of indicator may not be appropriate for explaining an important component of trade flows.

All of the real exchange rate indices discussed in this paper, except for the relative price of traded to nontraded goods, are sensitive to the weighting scheme adopted involving trading partners. Real exchange rate indicators usually involve the comparison of a domestic index with the same index in the partner country, but this "partner" is in reality a weighted average of the index in all competing countries. 1/ Thus, any computed real exchange rate index will depend on the adopted weighing scheme. 2/

An important consideration concerning the usefulness of alternative indicators is the amount of information contained in the indicator and its relevance for explaining the balance of trade in goods and nonfactor services. As the objective of using an indicator is to provide information for an assessment of movements in a country's trade balance, indicators which include information on both exports and imports are preferable to those which contain information on only one component of the trade balance. For example, export unit values of manufacturing products contain information for an assessment of exports, but other indicators such as normalized unit labor costs in the manufacturing sector contain information on both exports and imports to the extent that both of these fall into the

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1/ For a discussion of the weights used in the construction of export unit value indices, see McGuirk (1986). For an example of the sensitivity in calculating effective exchange rates to changes in MERM weights, see Masson (1987).

2/ Information Notice System (INS) weights are based on trade data over the period from 1980-82. These weights are currently being revised by the Policy Development Review Department of the IMF and they are expected to be available in 1994. See the data appendix at the end of the paper for a full discussion of the issue of the weights.

category of manufacturing products. In this regard, a general real exchange rate measure would be the relative price of traded goods, defined as:

$$RER_T = \frac{E\ P_T}{P_{T^*}} \tag{3}$$

where P_T denotes the price of the home country's traded goods and P_T* denotes the prices of traded goods in the foreign country. The real exchange rate defined in (3) encompasses information on both exports and imports, so it possesses an advantage over a real exchange rate index based on export unit values. 1/ Also, the definition in (3) may be particularly useful for the case of differentiated products, which is discussed below.

Indices based on manufacturing products alone cannot fully explain trade flows because they exclude information on a wide class of traded goods, such as agricultural commodities. The two indicators which are the "most comprehensive" are real exchange rates based on consumer price indices and the relative price of traded to nontraded goods, as these encompass all sectors of the economy.

Basic Structure

To provide a unifying framework, it is useful to start with a basic structure that describes the production side of the economy. The approach followed here is similar to the approach used in Marston (1987) and Lipshitz and McDonald (1991).

To begin, the value-added functions for both traded and nontraded goods are given by:

$$V_T = F(L_T,\ K_T,\ t) \tag{4}$$

$$V_N = F(L_N,\ K_N,\ t) \tag{5}$$

where V_j denotes value added in sector j, L_j is employment in sector j, K_j is the amount of capital used in sector j, and t represents technical progress over time. Gross output of final goods, Z_j, is a function of value added V_j and intermediate inputs I_{ij}:

$$Z_T = F(V_T,\ I_{NT},\ I_T) \tag{6}$$

1/ Dornbusch (1986) notes that it has become common to measure competitiveness by comparing the prices of manufacturing exports at home and abroad.

$$Z_N = F(V_N, I_N, I_{TN}) \tag{7}$$

where I_{NT} is the amount of nontraded goods used as an intermediate input in the production of traded goods, and I_{TN} is the amount of traded goods used as an intermediate input in the production of nontraded goods. The corresponding equations which define the prices of each final good are:

$$P_T = c_{VT}\, PV_T + c_{NT}\, P_N + c_T\, P_T \tag{8}$$

$$P_N = c_{VN}\, PV_N + c_N\, P_N + c_{TN}\, P_T \tag{9}$$

where:

PV_j = value-added price of the jth good;

c_{VJ} = the share of value added in the output of the jth final good;

c_{NT} = the share of nontraded intermediate inputs in the output of traded goods;

c_T = the share of traded intermediate goods in the output of traded goods;

c_N = the share of nontraded intermediate goods in the output of nontraded goods; and

c_{TN} = the share of traded goods used as an intermediate input in the production of nontraded goods.

Value-added prices are related to wages by:

$$PV_T\ (\ MPL_T(L_T,\ K_T)\ ) = W_T \tag{10}$$

$$PV_N\ (\ MPL_N(L_N,\ K_N)\ ) = W_N \tag{11}$$

where MPL_j is the marginal product of labor employed in the jth sector and W_j is the wage in the jth sector.

<u>Real exchange rate indicators using consumer prices</u>

One frequently used indicator of competitiveness is a real exchange rate index computed using consumer price indices which takes the form:

$$RER_{CPI} = \frac{E\ CPI_H}{CPI_F} \tag{12}$$

where CPI_H is the consumer price index in the home country, and CPI_F is the consumer price index in the home country's trading partner. By construction, this index is comprised of the prices at the consumer level, rather than prices at the producer or wholesale level. A rise in the consumer price index of the home country relative to the consumer price index in the foreign country, i.e., a real appreciation, would be associated with a loss in competitiveness of the home country and therefore a deterioration in the trade balance of the home country.

As the consumer price index is comprised of both traded and nontraded goods, each consumer price index can be written:

$$RER_{CPI} = \frac{E\ CPI_H}{CPI_F} = \frac{E\ P_T^{\alpha_T}\ P_N^{\alpha_N}}{P_{T^*}^{\alpha_{T^*}}\ P_{N^*}^{\alpha_{N^*}}} \tag{13}$$

where $\alpha_T + \alpha_N = 1$, and $\alpha_T^* + \alpha_N^* = 1$. In the extreme case where all traded goods are homogeneous, then EP_T will equal P_T^*. If the weights of each type of good in the domestic and foreign CPIs are equal (i.e., $EP_T = P_T^*$, $\alpha_T = \alpha_T^*$, and $\alpha_N = \alpha_N^*$), then:

$$\frac{E\ \ CPI_H}{CPI_F} = \frac{E^{\alpha_N}\ (P_N)^{\alpha_N}}{(P_N^*)^{\alpha_N}} \tag{14}$$

Under these restrictive assumptions, a real exchange rate index based on the ratio of consumer price indices would be a function only of the price of nontraded goods in the home country relative to the price of nontraded goods in the foreign country. In practice, however, traded goods are generally not homogeneous, therefore $EP_T \neq P_T^*$ and the ratio of consumer price indices becomes a function of the prices of traded and nontraded goods.

As noted by Turner and Van 't dack (1993) and Wickham (1993), a fundamental problem inherent in using CPIs is that the consumer price index is subject to the influence of price controls and other distortions which may introduce "noise" into the performance of the indicator. If the objective is to measure the relative price of traded goods, as shown in equation (3), then Turner and Van 't dack (1993) argue that the consumer price index may be a poor proxy for the price of traded goods. The reason for this is that the consumer price index includes the prices of services, many of which are nontraded. Furthermore, a large portion of trade is in intermediate goods and therefore much of international trade does not take place at consumer prices. These two facts may diminish the usefulness of relying on a real exchange rate based on consumer prices to explain the balance of trade in goods.

Despite these disadvantages, consumer price indices possess some advantages. As Turner and Van 't dack (1993) note, consumer price indices are calculated based on a basket of goods that is fairly comparable across countries. Consumer price indices are constructed with a high degree of accuracy, are readily available, and are published frequently. As it is important for any indicator of competitiveness to provide information on the profitability of producing traded goods, Enoch (1978) and Turner and Van 't dack (1993) suggest that consumer price indices may accurately reflect factor costs. They argue that many productive inputs, such as labor, are priced in line with consumer prices, so consumer price indices may provide a useful indicator of the costs of production. 1/

Real exchange rates based on export unit values

A second indicator often used to assess price competitiveness is a real exchange rate index based on export unit values of manufacturing products, as these products account for a large proportion of trade in goods. This index is computed by comparing the home country's export unit values (UV_X) with the export unit values of competitors in a given market ($UV_X{*}$), expressing both in the same currency:

$$RER_{XUVM} = \frac{E\,UV_X}{UV_{X^*}} \qquad (15)$$

It should be noted that export unit values themselves are not the actual prices at which transactions take place, but rather serve as proxies for the prices of exports. 2/ If export unit values are good proxies for the actual prices of exports, then a comparison of export unit values provides useful information relevant for an assessment of a country's export performance. If the unit values of the home country's exports fall relative to the unit values of a competitor's exports, then exports from the home country would be expected to increase, leading to an improvement in the trade balance.

1/ Others, such as Khan (1986) dispute this point by saying that the linkage between production costs and consumer prices may hold only in the short run. Wickham (1993) argues that CPIs may not reflect underlying developments in factor costs.

2/ Export unit values are computed by dividing the nominal value of exports by quantity, so they measure the average value of exports per physical unit. A similar definition applies to import unit values. A detailed discussion of this procedure is contained in Maciejewski (1983).

In the extreme case where all traded goods are homogeneous, the prices of traded goods must be equalized, so the ratio of export unit values equals one if E $UV_X = UV_X^*$, and from (15) $RER_{XUVM} = 1.0$. Therefore, in this case--for example, a good like wheat--the ratio of export unit values has no implications for competitiveness. However, as this assumption is far too restrictive, models of international trade have increasingly adopted a structure where traded goods are considered to be imperfect substitutes based on country of origin, as described by Armington (1969). When traded goods are heterogeneous across suppliers, their prices are no longer identical. In this case, a comparison of the export unit values of competitor products in a given import market is indeed meaningful. In the framework of an Armington-type model, consumers in a given importing region are assumed to engage in a three-stage procedure to determine the allocation of expenditure among nontraded goods, import competing goods, and imports from various sources.

In the first stage, consumers determine the mix of expenditure between an aggregate of all traded goods and home (nontraded) goods based on relative prices:

$$C = G_1(T,N) \tag{16}$$

where C is an aggregate of traded and nontraded goods, T is consumption of aggregate traded goods, and N is consumption of nontradables. If the consumer minimizes the expenditure of consuming both goods subject to a given level of C, then the mix of expenditure between T and N will depend on their relative prices and the elasticity of substitution between nontraded goods and traded goods, σ_{NT}:

$$\frac{T}{N} = G_2[(\frac{P_N}{P_T}), \sigma_{NT}] \tag{17}$$

In the second stage, consumers determine the allocation of total expenditure on tradables from stage one between aggregate imports and the domestic import competing good. The tradables aggregate (T) is a function of aggregate imports and the domestic, import-competing good:

$$T = G_3(M,MC) \tag{18}$$

Expenditure between aggregate imports and the import competing good is a function of relative prices and the elasticity of substitution between aggregate imports and import competing goods $\sigma_{M,MC}$:

$$\frac{M}{MC} = G_4[(\frac{P_{MC}}{P_M}), \sigma_{M,MC}] \tag{19}$$

At the final stage, the allocation of expenditure on aggregate imports among sources is also a function of their relative prices and the elasticity of substitution between imports from source A and source B $\sigma_{MA,MB}$:

$$\frac{M_A}{M_B} = G_5[(\frac{P_{MB}}{P_{MA}}), \sigma_{MA,MB}] \tag{20}$$

where PM_A is the price of imports from source A and PM_B is the price of imports from source B. Thus, at stage one, consumers decide on the allocation of expenditure between traded and nontraded goods based on the relative price of nontraded to traded goods, and in stage two, allocate their expenditure on a composite of all traded goods based on the price of aggregate imports relative to the price of the domestic import-competing good. At the final stage, aggregate expenditure on imports is determined based on the prices of imports by source country. This type of structure allows the prices of imports to differ by country of origin, and thus, captures the phenomenon of two-way trade because goods are heterogeneous.

In the context of the imperfect substitutes model, a comparison of the prices of traded goods from different sources captures the incentives which guide consumers in stage three of the decision process, rather than the relevant incentives in stage one. As noted by McGuirk (1986), comparing the unit values of exports in a given import market implicitly adopts a view of competitiveness based on competition among exporters in a given import market, and is not a view based on the relative incentives to produce tradable and nontradable goods. 1/

There are a number of difficulties inherent in a real exchange rate index based on export unit values. The usefulness of export unit values as an indicator of competitiveness depends on how closely movements in the indicator are associated with changes in the trade balance. Although a comparison of export unit values contains information that is directly relevant for assessing changes in exports, i.e., export prices, the comparison does not contain information relevant for assessing the performance of imports, so in this sense an indicator based on export unit values may not incorporate fully the information on competitiveness needed to explain movements in the trade balance. Moreover, as noted above, export

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1/ Durand and Giorno (1987) describe the procedures used by the OECD to compute measures of import and export price competitiveness. In the computation of the measure of import competitiveness, the OECD computes an aggregate price index of competitors products and compares this index with the price of the domestically produced, import competing good. For exports, a composite price of exports of a given country's competitors is calculated by a double-weighting scheme. The export competitiveness of a given country is then calculated by comparing the its export price with the composite export price of its competitors. See also the paper by McGuirk (1986) for a further discussion.

unit values are not true prices; they are average values. As such, a comparison of export unit values is sensitive to the composition of exports across countries. It is possible that fluctuations in export unit values are a consequence of changes in the composition of exports across countries, which is unrelated to competitiveness.

To the extent that the competitive situation in the export market involves "pricing to market," a comparison of export unit values may not reflect underlying competitiveness, i.e., the relative cost position of the country. Turner and Van 't dack (1993) make the point that international competition among sellers places a limit on the extent to which export prices may deviate from each other. This competition may force some exporters to accept prices that do not cover costs of production, which may be possible in the short run, but not in the long run. As a consequence, all potentially exportable goods will not be included in an export unit value index. This is an important shortcoming of comparing export unit values because the index will exclude some goods whose costs exceed world prices, and thus, are not exported. Comparison of export unit value indices will then not provide information on how changes in competitiveness are related to the export performance of goods that are excluded from the index. To get a comprehensive picture of a country's "underlying competitiveness," it would be useful to have an indicator that provided information on goods that are currently tradable as well as goods that are *potentially tradable*.

Real exchange rate as the relative price of traded to nontraded goods

In an important strand of literature on open economies, many economists have calculated the real exchange rate as the relative price of traded to nontraded goods and noted the importance of this relative price in terms of its relationship to a country's external position. 1/ The real exchange rate defined in this manner is:

$$RER = \frac{P_N}{P_T} \tag{21}$$

where P_T is a price index of tradable goods and P_N is a price index of nontradable (home) goods. As it is difficult in practice to delineate traded goods from nontraded goods, many economists, such as Marston (1987) and Milesi-Ferretti (1993), designate agricultural and manufacturing goods as traded goods and define the category of nontraded goods to include services (although many services are traded) and construction activities. Once this division is made, a real exchange rate can be computed based on sectoral value-added deflators or other price indices.

1/ For discussions of the role of the relative price of traded to nontraded goods, see Jones (1974), Dornbusch (1974a), Neary (1988), and Edwards (1989). Early work recognizing the importance of this relative price can be found in Salter (1959), Oppenheimer (1974), and Bruno (1976).

Many economists have analyzed how changes in the real exchange rate (P_N/P_T) are associated with changes in a country's trade balance. For example, Dornbusch (1974a) uses an economy's aggregate budget constraint to show that the balance of trade in goods equals excess demand in the market for nontraded goods, and thus if a country is initially running a trade surplus, then this surplus must be matched by an excess demand for nontraded goods. If the market for nontraded goods is to clear, the price of nontraded goods must rise relative to other goods; in this example, the price of nontraded goods must rise relative to the exogenous price of traded goods. A rise in P_N relative to P_T reduces the output of tradables and increases output of nontradables, which corresponds to a movement along the economy's production possibilities frontier. A rise in P_N/P_T will also increase domestic consumption of tradables and discourage consumption of nontradables. Lower production and greater consumption of tradables will reduce the trade surplus, while larger output and reduced consumption of nontradables will eliminate the excess demand. Thus, the trade surplus is eliminated and equilibrium in the market for the nontraded good is restored by a real exchange rate appreciation--a rise in P_N/P_T--so P_N/P_T plays an important role is bringing about changes in a country's external position.

While the relative price of traded to nontraded goods is an important relative price, looking at movements in this relative price alone is not sufficient as an indicator of competitiveness over time. As demonstrated by Lipshitz and McDonald (1991) and Marston (1987), changes in the relative price of tradables to nontradables may not be a reliable indicator of changes in competitiveness, especially when growth in labor productivity differs across sectors of the economy. Marston (1987) demonstrates that given the high growth in labor productivity in Japan's traded goods sector, an increase in P_N/P_T, i.e., a real appreciation, has nonetheless been associated with an improved trade position in Japan. Lipshitz and McDonald (1991) suggest that even if the price of tradables to nontradables is adjusted for differences in productivity, a rise in this relative price could be consistent with faster growth in the output of traded goods in the home country relative to partner countries if there are rigidities in factor markets and productivity growth in the traded goods sector is sufficiently large. Furthermore, as real per capita income rises over time, the relative price of nontradables will tend to rise (the relative price of tradables will fall). This shift in relative prices should not by itself suggest that the economy has suffered a loss of competitiveness.

Real exchange rate indicators using unit labor costs

Instead of focussing on indicators of competitiveness based on prices, a third indicator--an index of unit labor costs in a country's manufacturing sector--is often to used to assess competitiveness based on costs. For each country, the unit labor cost index is defined as the ratio of an index of hourly compensation per worker in the manufacturing sector to an index of output per man-hour. 1/ A real exchange rate indicator is then computed by dividing the index of unit labor costs in the home country by the index of unit labor costs for the sixteen industrial countries for which data are collected by the IMF. For example, the real exchange rate using unit labor costs is:

$$RER_{ULC} = \frac{E\ ULC_{MANF}}{ULC^{*}_{MANF}} = \frac{E\ (W_T\ L_T)/V_T}{(W_{T^*} L_{T^*})/V_{T^*}} \tag{22}$$

where all indices are expressed in a common currency. 2/ The numerator of equation (22) equals labor costs per unit of value added in the traded sector in the home country and the denominator is the corresponding value in the foreign country.

A real exchange rate based on unit labor costs may serve as an indicator of the profitability of producing tradable goods. Lipschitz and McDonald (1991) note that unit labor costs can provide information on the profitability of producing tradable goods if the prices of traded goods are linked through international competition, no intermediate inputs are used in production, the capital stock is fixed, and technology is homogeneous across countries. Under these circumstances, a rise in unit labor costs in the manufacturing sector in the home country, relative to the foreign country, will be associated with a loss in competitiveness and a deterioration of the trade balance of the home country.

Using unit labor costs for an assessment of competitiveness has a number of advantages. For industrial countries, data on wage costs are widely available on a comparable basis across countries. It is also reasonable to focus on developments in labor costs as many industrial countries have singled out the containment of wage costs as an important component of policies designed to achieve macroeconomic stability. Moreover, unit labor costs provide information on an important component of production costs that is nontraded and this is useful information as labor costs can differ widely across countries. Therefore, unit labor costs reveal important information about underlying costs of production.

There are, however, circumstances in which movements in unit labor costs can give misleading signals concerning changes in a country's trade balance. For example, production activities typically use inputs other than labor such as capital and intermediate inputs. Changes in the prices of these inputs have implications for competitiveness that would be undetected from just an examination of unit labor costs. As Lipshitz and McDonald

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1/ One version of unit labor costs is normalized, that is, the cyclic variation is removed by using a Hodrick-Prescott filter.

2/ For further details on the construction of the index, see Artus and Knight (1984). In practice, this index uses real output rather than value added in the figures reported in the IFS.

(1991) point out, when intermediate inputs are important in the production process and their prices vary significantly across countries, then changes in unit labor costs may not be indicative of a change in competitiveness. For example, if the price of an intermediate input such as oil rises differentially in one country, then profits would be reduced for a given price of final output, P_T. In this case, the country in question has suffered a loss in competitiveness, yet this loss may not necessarily be captured by movements in an indicator based on unit labor costs.

According to Turner and Van t' dack (1993), unit labor costs possess two drawbacks. First, it is possible that a unit labor cost indicator will provide a misleading impression concerning a country's competitiveness in the case where gains in productivity result from a substitution of capital for labor. In this case, the substitution of capital for labor will result in a lower unit labor cost index, but higher capital costs, so the observed decline in unit labor costs may actually overstate any improvement in competitiveness. In addition, unit labor costs are highly sensitive to cyclical movements in labor productivity over the course of the business cycle. An attempt is made to control for these cyclical effects by basing unit labor costs on trend productivity rather than short-run changes in productivity. 1/

An indicator based on the profitability of producing traded goods

Given the potential shortcomings of relying exclusively on movements in unit labor costs, Lipshitz and McDonald (1991) propose an alternative indicator--a profit-based indicator--as a preferred measure of competitiveness. This profit-based indicator is constructed by dividing the real exchange rate based on unit labor costs by an indicator based on value-added prices:

$$RER_{PRF} = \frac{RER_{ULC}}{RER_{PV_T}} = \frac{\frac{ULC_T}{ULC_{T^*}}}{\frac{PV_T}{PV_{T^*}}} \tag{23}$$

where PV_T is the value-added deflator in the tradable sector. Substituting for ULC_T from equation (22), equation (23) can be written:

1/ As mentioned above, one version of unit labor costs is normalized to remove cyclical variation in labor productivity.

$$RER_{PRF} = \frac{RER_{ULC}}{RER_{PV_T}} = \frac{\dfrac{W_T\, L_T}{PV_T\, V_T}}{\dfrac{W_{T^*}\, L_{T^*}}{PV_{T^*} V_{T^*}}} \tag{24}$$

which shows that the profit-based measure, RER_{PRF} reduces to the ratio of the share of labor costs in valued added in the tradable sector of the home country to the tradable sector in the foreign country. According to Lipshitz and McDonald (1991), the inverse of the labor share in value added can be interpreted as an indicator of the profitability or the return to capital of producing tradable goods. 1/ A rise in RER_{PRF} would be associated with a loss in competitiveness and a deterioration in the trade balance because the share of labor costs in value added has risen, relative to competitors, resulting in a squeeze on the profitability of producing traded goods in the home country. Unlike the indicator based on unit labor costs, this profit-based indicator would capture a loss in competitiveness which comes about as a result of a rise in the price of an intermediate input. In this case, for a given price of the final good, an increase in the price of an intermediate good would reduce the value-added price PV_T, thus the profit-based measure would show an appreciation and a loss in competitiveness. 2/

Relationship among indicators of competitiveness

The purpose of this section is to provide a discussion of how three of the most commonly used indicators of competitiveness relate to each other. This section relates the indicators based on consumer prices, export unit values in manufacturing, and unit labor costs. All remaining comparisons among indicators are contained in Appendix I.

1/ The real exchange rate indicator based on profitability bears a relationship to the notion of the effective rate of protection in international trade theory. The effective rate of protection measures the degree of protection afforded to value added in a particular sector of the economy, which includes labor and capital income. The rationale behind using RER_{PRF} is that it provides a measure of profitability or the return to capital in the traded sector.

2/ The usefulness of the indicator based on profitability has been demonstrated in an analysis of the competitiveness of Italy over the period of 1977 to 1988. In this case, a real exchange rate indicator based solely on unit labor costs provided a misleading impression of the competitiveness of the Italian manufacturing sector. The real exchange rate indicator based on profitability in the manufacturing sector, as suggested by Lipshitz and McDonald (1991), gives a picture which is much more in line with actual changes in the competitive position of Italy's manufacturing sector, measured by changes in relative manufacturing output and productivity developments.

Consumer price indices and export unit values

The consumer price index is defined as follows:

$$CPI = \prod_{j=1}^{j} P_j^{\alpha_j} \tag{25}$$

where α_j is the weight assigned to the jth good in the index. The price index is comprised of all final, consumer-good, prices, so RER_{CPI} can be expressed as:

$$RER_{CPI} = \frac{E \prod_j P_j^{\alpha_j}}{\prod_j P_j^{*\,\alpha_j^*}} = \frac{E\, P_M^{\alpha_M}\, P_X^{\alpha_X}\, P_N^{\alpha_N}}{P_M^{*\,\alpha_M^*}\, P_X^{*\,\alpha_X^*}\, P_N^{*\,\alpha_N^*}} \tag{26}$$

where a * denotes a variable in the foreign country. In the extreme case where the prices and weights of traded goods and are equal across countries, the real exchange rate indicator based on a ratio of CPIs is a function of the prices of nontraded goods in two countries, as discussed above. Under more general conditions, a real exchange rate indicator based on consumer prices is a function of the prices of all consumer goods in the home country, including traded and nontraded goods, relative to all prices in the foreign country as shown in equation (26). By contrast, a real exchange rate index using export unit values is simply a comparison of export unit values among competitors in a given export market; thus a comparison of export unit values uses proxies for one component of the consumer price index, the prices of exportable goods consumed at home. The consumer price index includes the price of exportable goods purchased by domestic consumers, while export unit values are proxies for the actual prices of exports. Comparing these two indicators, a real exchange rate based on consumer price indices is preferable since it provides information on the prices of exports and imports rather than on just one component of the trade balance, and consumer price indices are readily available.

Consumer price indices and unit labor costs

As shown in equation (26), the ratio of the CPIs in two countries can be expressed as a function of all final goods prices. The relationship between the final goods prices and the factor prices can be demonstrated by substituting the price equations (8-9) into equation (13):

$$RER_{CPI} = \frac{E\, CPI_H}{CPI_F} = \frac{E\ (c_{VT}\, PV_T + c_{NT}\, P_N + c_T\, P_T)^{\alpha_T}\ (c_{VN}\, PV_N + c_N\, P_N + c_{TN}\, P_T)^{\alpha_N}}{(c_{VT*}\, PV_{T*} + c_{NT*}\, P_{N*} + c_{T*}\, P_{T*})^{\alpha_{T*}}\ (c_{VN*}\, PV_{N*} + c_{N*}\, P_{N*} + c_{TN*} P_{T*})^{\alpha_{N*}}} \tag{27}$$

Each value-added price in the traded sector PV_T, can be written as a function of labor and capital costs (profits):

$$PV_j\, V_j = W_j\, L_j + R_j\, K_j \tag{28}$$

where R_j is the return to capital in sector j and K_j is the capital stock in sector j. Equation (28) can be written:

$$PV_j = (W_j\, L_j)/V_j + (R_j\, K_j)/V_j \tag{29}$$

or:

$$PV_j = ULC_j + profit_j \tag{30}$$

where profit equals capital income per unit of value added in sector j. Equation (30) can be substituted into equation (27), giving the relationship between CPIs and unit labor costs:

$$RER_{CPI} = \frac{E\ [c_{VT}\ (ULC_T + profit_T) + c_{NT}\, P_N + c_T\, P_T]^{\alpha_T} [c_{VN}\ (ULC_N + profit_N) + c_N\, P_N + c_{TN}\, P_T]^{\alpha_N}}{[c_{VT*}(ULC_{T*}+profit_{T*})+c_{NT*}P_{N*}+c_{T*}P_{T*}]^{\alpha_{T*}}\ [c_{VN*}(ULC_{N*}+profit_{N*})+c_{N*}P_{N*}+c_{TN*}P_{T*}]^{\alpha_{N*}}} \tag{31}$$

From equation (31), the ratio of CPIs is a function of unit labor costs in the traded and nontraded sectors, which encompasses more information than a simple comparison of unit labor costs in the manufacturing sectors across countries. Thus, a real exchange rate index based on unit labor costs in manufacturing contains a subset of the information contained in a real exchange rate index based on the ratio of CPIs. The additional information obtained from using CPIs may be relevant from an economy-wide point of view because developments in an economy's nontraded sector may have important implications for the performance of the traded sector, especially if factors of production are mobile across sectors. Furthermore, there may be instances where a real exchange rate based on consumer price indices may provide a signal of a change in competitiveness that would not be detected by unit labor costs. For example, as mentioned above, a rise in the price of an important intermediate input may erode competitiveness, but the indicator based on unit labor costs will not necessarily detect this loss in competitiveness. To the extent that increases in production costs are passed on to consumers in the form of higher prices, the consumer price index will capture this price increase and signal a loss in competitiveness. Also, consumer prices may show movements in the prices of traded goods which do not fall under the category of manufacturing goods.

However, real exchange rates based on consumer prices are not necessarily superior to unit labor costs. Consumer price indices tend to exhibit much more volatility than normalized unit costs because consumer prices are sensitive to position of the economy in the business cycle. Furthermore, normalized unit labor costs are more narrowly focused on the traded goods sector than consumer price indices, so it is possible that fluctuations in consumer prices are unrelated to changes in competitiveness. For these reasons, normalized unit labor costs possess advantages over consumer price indices.

Comparison of export unit values with unit labor costs

As noted above, the only case in which the comparison of export unit values is meaningful is the case where traded goods are heterogeneous. In this case, a comparison of export unit values is equivalent to a comparison of all the prices of inputs used in producing exportable goods. The ratio of export unit values can be written:

$$RER_{XUVM} = \frac{E \; c_{VX} \; (ULC_X + profit_X) + c_{NX} \, P_N + c_T \, P_T}{[c_{VX^*}(ULC_{X^*} + profit_{X^*}) + c_{NX^*} \, P_{N^*} + c_{T^*} \, P_{T^*}]} \qquad (32)$$

which is a function of unit labor costs in the exportable sector, as well as the prices of traded and nontraded intermediate inputs. Thus, when comparing export unit values, there is an implicit comparison of unit labor costs in the exportable sector across countries; however, this comparison does not include information on unit labor costs in the importable sector. Real exchange rates based on unit labor costs compare unit labor costs in the manufacturing sectors across countries, which is more comprehensive in coverage. The additional information (coverage) contained in a comparison of unit labor costs is important for an assessment of a country's trade balance since RER_{ULC} contains some information concerning imports, so this wider coverage represents a distinct advantage of using unit costs.

Summary

Overall, each measure of the real exchange rate possesses shortcomings, and no one indicator provides an unambiguous assessment of competitiveness, which is a conclusion shared by Durand and Giorno (1987), Dornbusch (1986), and Turner and Van 't dack (1993). Wickham (1993) concludes that reliance on competitiveness indicators should only form part of any assessment of the appropriateness of a country's exchange rate, given the many limitations inherent in the construction of these indicators. Some authors, such as Artus and Knight (1984), make the case that a real exchange rate based on normalized unit labor costs in manufacturing is the preferred indicator of competitiveness, while others such as Lipshitz and McDonald (1991) argue that RER_{PRF} is the preferred indicator. In the end, each indicator discussed above does not provide a complete assessment of competitiveness **by itself**. If anything, the above discussion suggests that competitiveness indicators should be used in conjunction with other indicators, in order to obtain an assessment of competitiveness that is as complete as possible.

However, if only one of the three commonly used real exchange rate indices can be selected (RERs based export unit values, consumer price indices, and normalized unit labor costs), then unit labor costs seem to be the most useful for assessing competitiveness. Export unit values provide information on only one component of trade (exports), cover only exported goods rather than potentially exportable goods, and the composition of goods contained in an export basket is likely to differ across countries. Consumer price indices are subject to the influence of distortions, e.g., *taxes, do not include prices of intermediate goods which make up a large* component of the volume of trade, and are subject to volatility over the business cycle. Normalized unit labor costs in manufacturing possess the advantages that they provide information on both exports and imports and are not subject to the volatility inherent in consumer price indices. 1/ As the business cycle proceeds, consumer price indices may exhibit volatility unrelated to competitiveness since the consumer price index contains nontraded goods. 2/ Thus, use of normalized unit labor costs in manufacturing overcomes this difficulty. For an assessment of competitiveness across well-diversified industrial countries, normalized unit labor costs are the preferred indicator since they are readily comparable across countries and information on labor costs is generally available. For developing countries, however, data on unit labor costs are often nonexistent, so real exchange rates based on consumer prices are often the only alternative, a point make by Wickham (1993). 3/ Despite the

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1/ A Hodrick-Prescott filter is used to remove cyclical variations in unit labor costs. For this reason, Artus and Knight (1984) argue that normalized unit labor costs are the most useful for assessing exchange rates. They also compared the movements of real exchange rates based on consumer prices with those based on normalized unit labor costs for Japan/United States, Japan/Germany, and Japan/United Kingdom. They concluded that even though both real exchange rates may give similar indications of short-run developments in competitiveness, normalized unit labor costs are superior for an analysis of competitiveness over several years.

2/ From a longer term perspective, as real per capita income grows, the price of nontraded to traded goods tends to rise. This should not necessarily be interpreted as a decline in competitiveness and is a drawback of focussing exclusively on the relative price of traded to nontraded goods.

3/ As noted in the data appendix, the IMF uses industrial country weights to compute real exchange rates. In the case of the United States for example, Mexico would be excluded. This represents a potential shortcoming of ULC-based real exchange rates because these calculations neglect the importance of developing country trading partners.

advantages of unit labor costs, it cannot be overstressed that any single indicator of competitiveness fails to provide a complete and satisfactory assessment of competitiveness in all cases and the basis for selecting normalized unit labor costs is rather weak.

III. The Data and Estimation Strategy

Given that each of the five indicators discussed above possesses shortcomings and no one indicator by itself provides an unambiguous assessment of competitiveness, an empirical investigation is called for--which measure of the real exchange rate performs best in explaining trade in goods and nonfactor services? In this empirical section, we restrict our analysis to three indicators of competitiveness: real exchange rates based on consumer prices, export unit values in manufacturing, and normalized unit labor costs in manufacturing.

Our concept of competitiveness relates to the external balance of a country. However, it only relates to that part of a country's external balance which is subject to international competition, and for this reason transfers are not considered. More questionably, some might say, we also exclude factor services. It could be argued that factor service payments are the result of factor flows, which are themselves influenced by competitiveness considerations. For example, a relatively cheap labor force attracts capital which eventually result in interest and dividend payments. However, these payments are related to historical competitiveness and their inclusion could obscure the relationship between recent competitiveness levels and external balance.

We view the external balance of a country, net of transfers and factor service payments, as a function of domestic and foreign income and the real exchange rate, as shown in equations (1) and (2). However, estimating an equation for the difference between two large numbers can lead to imprecise parameter estimates and we have chosen to model the external balance as its constituent import and export terms. To preserve the connection with external balance and to determine whether a single indicator of competitiveness performs best, we use total trade weights to compute the real exchange rate terms, rather than using import (export) weights for the imports (exports) equation. 1/

There are a multitude of potential approaches to modelling trade flows, none of which are without problems. Full models of trade performance would include estimated price and volume equations for imports and exports, with different specifications for agricultural products, petroleum and other commodity trade. 2/ Such models could then be evaluated on the basis of

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1/ See Data Appendix for a further discussion of the weights used.

2/ See Marquez and Ericsson (1990) for a comparison of various models of trade, and Masson, Symansky and Meredith (1990) for a discussion of MULTIMOD's trade equations.

their forecast performance or on their in-sample diagnostics (or both). This approach unfortunately consumes a lot of data (and time, especially as we wish to cover the G-7 countries to avoid focusing on the potential special case of the United States). Furthermore, making the real exchange rate endogenous in the model would require equations with different functional forms depending on the measure being used. This would not allow us to concentrate exclusively on the strengths of each alternative.

An alternative approach would be to conduct causality tests and impulse response analyses based on a VAR system. A particular advantage of this method is that the endogeneity of prices and incomes ceases to be an issue. However, this approach is not followed due to the sensitivity of the results to the ordering of equations in the system, and the fact that the estimated parameters are of little use in evaluating the alternative real exchange rate measures.

A third method based on cointegration analysis was suggested to us. 1/ If the three REER measures are all cointegrated pair-wise then, in the long-run, it should not be possible to differentiate between them. If they do not all cointegrate, either they will all fail to produce a cointegrating vector with trade flows and other determinants such as income terms (in which case a new approach is needed) or a subset will fail to cointegrate and so can be rejected in favor of those that do. Unfortunately, limited experimentation with the Johansen method of cointegration indicated that the results were very sensitive to specification of the underlying VAR, and we felt that a data span of fifteen years may not be long enough for cointegration analysis to prove conclusive. 2/

Our chosen method is as follows. For each G-7 country we run the following regression:

$$\Delta T_t = \alpha + \beta_1 \Delta Y_t + \beta_2 \Delta REER_t + [\beta_3 T + \beta_4 Y + \beta_5 REER]_{t-1} \tag{33}$$

where T is the (log of the) trade flow data discussed in more detail below, Y is an income term which takes the form of (log) real GDP of the country under consideration when we look at import flows and the (log) demand in

1/ We thank Stephen Hall for this suggestion and his comments on some of the rest of the paper.

2/ The results also proved supportive of our final conclusions in that no one REER measure proved to cointegrate consistently.

export markets when we examine exports, 1/ and REER is (the log of) one of the three alternative real effective exchange rate measures. 2/ We represent the first difference operator by Δ, where $\Delta X_t = X_t - X_{t-1}$. We disaggregate trade flows into imports and exports of goods and nonfactor services, goods, and manufactured goods, all measured in volume terms. We disaggregate for two reasons. First, though we would wish to explain trade in general we recognize that (i) service flows may be due to factors other than income and relative prices; and (ii) even the trade in goods includes basic commodities whose price may be fixed at a world level. Second, we would expect that, at least in the short-run, our real exchange rate measured with export unit values of manufactured goods would better explain manufactured exports, while the CPI-based approach would perform better when we look at the trade in goods and services. As noted in Section II, this implicitly adopts the view of competitiveness based on competition in a specific traded goods market, and ignores the nontraded sector. This may, however, be reasonable in the short-run when the movement of factors between sectors may be limited.

Ideally, we would like to think of equation (33) as an import or export demand curve. Therefore, it is reasonable to include variables that measure changes in relative prices (export unit values and consumer prices) and to include an income variable in these equations. Normalized unit labor costs are also used in these equations for two reasons. First, normalized unit labor costs may serve as proxies for actual commodity prices if the markup over production costs is constant. Second, the equations in (33) may be thought of as "reduced form" equations that are meant to explain exports and imports. Normalized unit labor costs are important variables that influence domestic production of both imports and exports, so it is important to account for the incentives to produce traded goods from the cost side.

Thus for each country we run 18 regressions (2 directions of trade flows × 3 levels of aggregation × 3 REER measures). The data and sources are discussed in the Data Appendix. Our sample is constrained by data availability and runs from 1975Q1 (the first quarter for which REERs based on unit labor costs are available) to 1991Q4 (the last quarter for which trade statistics are available). All lags and change terms are generated from within this sample.

1/ It could be argued that a domestic and foreign income term should be included in both the import and export equation, especially if exports are seen as an excess supply phenomenon. However, including two income terms tended to cause problems of colinearity, which made interpretation of conventional income elasticities difficult, without altering the REER-elasticities substantially. As we are focussing on the latter we chose to include only one income term.

2/ Note that with one exception which we shall discuss later, in the empirical part of this paper we shall be using real *effective* exchange rates.

In using this form of equation we have assumed that the commonly used imperfect substitutes model of international trade holds (see Goldstein and Khan, 1985). Thus we expect that, in the long-run at least, import (export) volumes respond positively to increases domestic (foreign) incomes, and negatively (positively) to increases in the real exchange rate.

Our equation has a simple error correction form, similar to that used by Burda and Gerlach (1992), Marquez (1992), and in MULTIMOD Mark II. This formulation is convenient since it allows us to easily compute the long-run elasticities of trade flows with respect to income ($-\beta_4/\beta_3$) and the real exchange rate ($-\beta_5/\beta_3$), and to assess the speed with which convergence to the long-run equilibrium proceeds (absolute value of β_3). It also allows different short- and long-run elasticities, and different dynamic responses to changes in income and prices. The immediate impact of changes in income and the real exchange rate are given by the coefficients on the difference terms. Following Marquez (1992), who uses an equivalent formulation, we reject a model which contradicts the sign restrictions on long-run elasticities implied by the imperfect substitutes model. We make no judgements based on the significance of the estimated short-term elasticities since the specification of dynamics is relatively limited in our equation and the speed of reaction of trade flows to price signals is likely to be sluggish. As we shall see when we consider specific results, short-term REER-elasticities typically cannot help in differentiating between alternative proxies for the real exchange rate since they are almost uniformly insignificant.

We would also hope that the estimated relationships are stable, and this is tested by including multiplicative dummies on the change in REER and lagged level of REER. The dummies take a value of zero for 1975Q1 to 1984Q4, and unity thereafter. This split in the sample is chosen since it coincides with the downturn in the nominal value of the U.S. dollar, and is a noticeable peak in the real exchange rate series for many countries. An F-test of the significance of these dummies is then used as a test of stability. A simple Chow test was considered but would leave open the question of which parameter is shifting. Our method focuses on the role of the real exchange rate in determining trade flows.

IV. The Estimations

The results of estimating equation (33) are given in Tables 1 through 7. A simple key has been added to aid in the evaluation of the performance of each equation. An 'A' is assigned to an equation if the computed elasticities are correctly signed and if the levels terms in the equation are statistically significant. A 'B' is assigned if the signs of the elasticities are correct but at least one of the levels terms are not significant. In most but not all cases, this is due to estimates of β_5, the coefficient on the real effective exchange rate, that are not significantly different from zero. If an estimated long-run elasticity bears the wrong sign, an 'E' is awarded and this configuration is rejected. The two remaining classifications, 'C' and 'D', are assigned if there is evidence of

Table 1. United States: Econometric Results from Estimating Equation (33)

Country	Variable	REER	Change in Income	Change in REER	Lagged Var Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
United States	EGS	ULC	2.074	-0.021	-0.113	0.169	-0.085	32.7%	1.49	-0.75		B
			(2.18)	(0.30)	(1.98)	(2.59)	(2.84)					
		CPI	2.186	-0.000	-0.115	0.178	-0.106	34.7%	1.55	-0.92		A
			(2.45)	(0.00)	(2.23)	(2.94)	(3.25)					
		XUVM	2.086	-0.084	-0.124	0.218	-0.128	36.8%	1.77	-1.03		A
			(2.37)	(0.94)	(2.21)	(2.95)	(3.32)					
	EG	ULC	2.078	0.004	-0.117	0.167	-0.104	27.7%	1.42	-0.89		A
			(1.73)	(0.05)	(2.05)	(2.79)	(2.91)					
		CPI	2.165	0.009	-0.120	0.178	-0.131	29.8%	1.48	-1.09		A
			(1.89)	(0.10)	(2.25)	(3.07)	(3.25)					
		XUVM	2.102	-0.125	-0.121	0.213	-0.151	30.9%	1.76	-1.25		A
			(1.84)	(1.09)	(2.05)	(2.89)	(3.09)					
	EG(M)	*ULC*	*2.898*	*0.002*	*-0.120*	*0.194*	*-0.120*	*27.5%*	*1.62*	*-1.00*		A
			(2.18)	(0.02)	(2.19)	(3.18)	(2.67)					
		CPI	3.152	0.016	-0.112	0.195	-0.141	28.8%	1.74	-1.26		A
			(2.49)	(0.14)	(2.28)	(3.37)	(2.88)					
		XUVM	2.930	-0.128	-0.126	0.251	-0.176	30.1%	1.99	-1.39		A
			(2.34)	(0.96)	(2.31)	(3.30)	(2.93)					
	MGS	ULC	1.883	0.011	-0.211	0.525	0.063	25.8%	2.49	0.30		A
			(4.66)	(0.11)	(2.56)	(2.56)	(2.44)					
		CPI	1.884	-0.001	-0.241	0.593	0.092	28.8%	2.47	0.38		A
			(4.73)	(0.01)	(2.89)	(2.88)	(2.96)					
		XUVM	1.818	-0.120	-0.270	0.618	0.113	32.5%	2.29	0.42		A
			(4.73)	(0.97)	(3.39)	(3.24)	(3.49)					
	MG	ULC	2.036	-0.007	-0.231	0.587	0.059	25.7%	2.54	0.25		A
			(4.57)	(0.07)	(2.69)	(2.66)	(2.12)					
		CPI	2.023	-0.019	-0.251	0.632	0.085	28.0%	2.52	0.34		A
			(4.60)	(0.16)	(2.90)	(2.86)	(2.57)					
		XUVM	1.953	-0.170	-0.289	0.681	0.106	31.7%	2.36	0.37		A
			(4.57)	(1.21)	(3.42)	(3.25)	(3.04)					
	MG(M)	ULC	2.131	-0.026	-0.326	1.095	0.164	29.6%	3.36	0.50		A
			(4.55)	(0.24)	(3.81)	(3.74)	(3.85)					
		CPI	2.086	-0.036	-0.344	1.139	0.213	32.7%	3.31	0.62		A
			(4.59)	(0.32)	(4.18)	(4.09)	(4.28)					
		XUVM	1.938	-0.147	-0.380	1.158	0.261	39.0%	3.05	0.69		A
			(4.52)	(1.12)	(4.91)	(4.70)	(5.10)					

Notes: Variable column denotes whether the dependent variable is the change in exports of goods and services (EGS), exports of goods (EG), exports of manufactured goods (EG(M)), imports of goods and services (MGS), imports of goods (MG) or imports of manufactured goods (MG(M)).

REER column denotes the price variable included in the real exchange rate. ULC is normalized unit labor costs, CPI is the consumer price index and XUVM is the export unit value of manufactured goods.

Elasticities are defined such that income elasticities are expected to be positive and REER elasticities are expected to be negative (positive) for exports (imports).

Shift denotes the marginal significance of a test that the change in price and lagged price terms are constant over the full sample (see text for details). Values are only given when the test is rejected at 5% level.

Key classifies the performance of the estimated equations according to the following schema: A denotes that the long-run coefficients are correctly signed and significant, B that they are correctly signed but insignificant, C that there is evidence of a shift in the relationship between REER and the trade variable but that coefficients are significant and correct, D that there is a shift in an equation with insignificant coefficients and E denotes that at least one of the long-run coefficients is incorrectly signed (whether significant or not).

Table 2. Germany: Econometric Results from Estimating Equation (33)

Country	Variable	REER	Change In Income	Change In Reer	Lagged VAR Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
Germany	EGS	ULC	0.129	-0.237	-0.138	0.396	-0.111	8.6%	2.87	-0.80		B
			(0.11)	(1.83)	(1.76)	(2.21)	(1.66)					
		CPI	-0.258	-0.114	-0.145	0.287	-0.075	2.8%	1.98	-0.51		B
			(0.21)	(0.60)	(1.75)	(1.93)	(1.04)					
		XUVM	-0.426	-0.144	-0.163	0.359	-0.110	5.1%	2.21	-0.67		B
			(0.37)	(0.86)	(2.01)	(2.26)	(1.52)					
	EG	ULC	3.808	0.194	-0.778	1.609	-0.357	51.8%	2.07	-0.46	0.032	C
			(4.15)	(1.55)	(8.10)	(7.95)	(5.19)					
		CPI	3.383	0.134	-0.679	1.039	-0.306	42.8%	1.53	-0.45	0.086	C
			(3.43)	(0.69)	(6.67)	(6.15)	(4.10)					
		XUVM	3.590	0.112	-0.755	1.323	-0.373	47.9%	1.75	-0.49		A
			(3.86)	(0.66)	(7.38)	(7.14)	(4.98)					
	EG(M)	ULC	4.552	0.206	-0.722	1.499	-0.311	48.6%	2.08	-0.43		A
			(4.69)	(1.58)	(7.49)	(7.43)	(4.59)					
		CPI	4.114	0.198	-0.656	1.028	-0.284	42.5%	1.57	-0.43		A
			(4.07)	(1.00)	(6.51)	(5.96)	(3.94)					
		XUVM	4.369	0.204	-0.723	1.286	-0.339	47.1%	1.78	-0.47		A
			(4.53)	(1.18)	(7.17)	(7.00)	(4.70)					
	MGS	ULC	0.701	-0.137	-0.409	0.807	0.027	21.8%	1.97	0.07		B
			(2.89)	(1.34)	(3.76)	(3.61)	(0.54)					
		CPI	0.760	-0.097	-0.421	0.883	0.079	23.0%	2.10	0.19		B
			(3.25)	(0.69)	(3.92)	(4.15)	(1.60)					
		XUVM	0.756	-0.116	-0.413	0.829	0.061	21.8%	2.01	0.15		B
			(3.20)	(0.88)	(3.83)	(3.90)	(1.15)					
	MG	ULC	1.197	0.295	-0.509	0.810	0.175	29.6%	1.59	0.34		A
			(4.17)	(2.46)	(4.73)	(4.11)	(2.88)					
		CPI	1.291	0.326	-0.580	1.193	0.213	29.4%	2.06	0.37	0.018	C
			(4.47)	(1.99)	(4.84)	(4.71)	(3.06)					
		XUVM	1.210	0.249	-0.539	1.004	0.203	27.2%	1.86	0.38	0.098	C
			(4.18)	(1.61)	(4.62)	(4.45)	(2.80)					
	MG(M)	ULC	1.424	0.343	-0.484	1.228	0.165	28.3%	2.54	0.34		A
			(4.18)	(2.52)	(4.35)	(3.91)	(2.44)					
		CPI	1.332	0.178	-0.398	1.145	0.042	18.2%	2.88	0.11	0.078	D
			(3.70)	(0.90)	(3.52)	(3.42)	(0.60)					
		XUVM	1.311	0.099	-0.399	1.125	0.077	18.4%	2.82	0.19	0.084	D
			(3.64)	(0.54)	(3.53)	(3.39)	(1.03)					

Table 3. Japan: Econometric Results from Estimating Equation (33)

Country	Variable	REER	Change In Income	Change In REER	Lagged Var Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
Japan	EGS	ULC	2.078	-0.312	-0.189	0.391	-0.132	34.9%	2.07	-0.70		A
			(2.63)	(5.01)	(2.93)	(3.11)	(3.22)					
		CPI	1.624	-0.363	-0.180	0.403	-0.136	35.0%	2.24	-0.76		A
			(2.17)	(5.22)	(2.86)	(2.99)	(2.88)					
		XUVM	0.290	-0.381	-0.165	0.301	-0.201	20.0%	1.83	-1.22		A
			(0.38)	(3.35)	(2.86)	(2.93)	(2.42)					
	EG	ULC	4.098	-0.146	-0.172	0.298	-0.171	32.4%	1.73	-1.00		A
			(4.55)	(2.05)	(3.51)	(3.94)	(5.01)					
		CPI	3.338	-0.148	-0.144	0.303	-0.181	29.5%	2.11	-1.25		A
			(3.92)	(1.79)	(3.00)	(3.84)	(4.66)					
		XUVM	2.527	-0.404	-0.146	0.209	-0.355	35.9%	1.43	-2.42		A
			(3.53)	(3.50)	(3.07)	(3.07)	(4.93)					
	EG(M)	ULC	4.084	-0.143	-0.168	0.294	-0.174	31.6%	1.75	-1.04		A
			(4.37)	(1.93)	(3.50)	(3.89)	(4.93)					
		CPI	3.324	-0.147	-0.140	0.299	-0.185	29.1%	2.14	-1.32		A
			(3.77)	(1.73)	(2.99)	(3.80)	(4.62)					
		XUVM	2.521	-0.424	-0.142	0.203	-0.363	35.9%	1.43	-2.56		A
			(3.41)	(3.57)	(3.05)	(3.01)	(4.88)					
	MGS	ULC	-0.455	-0.069	-0.046	0.029	0.147	31.9%	0.62	3.18		B
			(0.84)	(0.97)	(1.41)	(0.62)	(5.32)					
		CPI	-0.377	-0.030	-0.027	-0.056	0.182	33.1%	-2.08	6.69		E
			(0.71)	(0.38)	(0.83)	(1.11)	(5.56)					
		XUVM	-0.072	0.136	-0.053	0.076	0.353	23.9%	1.42	6.63		B
			(0.13)	(1.06)	(1.60)	(1.66)	(4.71)					
	MG	ULC	0.321	0.093	-0.112	0.103	0.117	18.2%	0.92	1.04		B
			(0.59)	(1.36)	(2.42)	(1.96)	(3.90)					
		CPI	0.369	0.177	-0.077	0.037	0.114	16.3%	0.48	1.49		B
			(0.68)	(2.28)	(1.71)	(0.71)	(3.32)					
		XUVM	0.548	0.329	-0.087	0.105	0.212	12.7%	1.21	2.45		B
			(0.99)	(2.68)	(1.88)	(1.91)	(2.69)					
	MG(M)	ULC	1.619	0.166	-0.263	0.633	0.206	26.4%	2.40	0.78		A
			(1.77)	(1.35)	(3.38)	(3.18)	(4.07)					
		CPI	1.587	0.265	-0.230	0.480	0.232	27.0%	2.09	1.01		A
			(1.74)	(1.96)	(3.12)	(2.60)	(4.02)					
		XUVM	1.946	0.493	-0.252	0.656	0.439	21.4%	2.60	1.74		A
			(2.06)	(2.36)	(3.31)	(3.28)	(3.22)					

Table 4. United Kingdom: Econometric Results from Estimating Equation (33)

Country	Variable	REER	Change In Income	Change In REER	Lagged Var Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
United Kingdom	EGS	ULC	1.222	-0.100	-0.694	0.850	-0.118	36.2%	1.23	-0.17		A
			(1.09)	(1.45)	(5.67)	(5.62)	(3.34)					
		CPI	0.780	-0.096	-0.777	0.956	-0.212	40.2%	1.23	-0.27		A
			(0.71)	(1.21)	(6.45)	(6.41)	(4.15)					
		XUVM	2.129	-0.061	-0.624	0.756	-0.186	33.3%	1.21	-0.30		A
			(2.05)	(0.61)	(5.55)	(5.51)	(3.05)					
	EG	ULC	0.681	-0.096	-0.887	1.302	-0.157	43.3%	1.47	-0.18		A
			(0.52)	(1.20)	(6.98)	(6.92)	(3.93)					
		CPI	0.354	-0.101	-0.932	1.370	-0.253	45.7%	1.47	-0.27		A
			(0.27)	(1.08)	(7.49)	(7.45)	(4.40)					
		XUVM	1.788	-0.048	-0.847	1.231	-0.274	42.5%	1.45	-0.32		A
			(1.50)	(0.42)	(6.96)	(6.91)	(3.85)					
	EG(M)	ULC	0.125	-0.171	-0.379	0.563	-0.192	21.1%	1.49	-0.51		A
			(0.07)	(1.56)	(3.98)	(4.09)	(3.07)					
		CPI	0.745	-0.152	-0.315	0.471	-0.209	15.9%	1.50	-0.66		A
			(0.40)	(1.12)	(3.63)	(3.75)	(2.49)					
		XUVM	1.847	-0.211	-0.284	0.417	-0.252	16.5%	1.47	-0.89		A
			(1.11)	(1.33)	(3.50)	(3.62)	(2.50)					
	MGS	ULC	0.777	-0.208	-0.500	1.036	-0.013	34.5%	2.07	-0.03		E
			(2.15)	(2.55)	(5.05)	(5.07)	(0.51)					
		CPI	0.864	-0.214	-0.501	1.039	-0.005	33.2%	2.07	-0.01		E
			(2.36)	(2.21)	(5.00)	(5.03)	(0.14)					
		XUVM	0.854	-0.245	-0.512	1.061	-0.083	33.4%	2.07	-0.16		E
			(2.41)	(2.20)	(5.02)	(5.04)	(1.45)					
	MG	ULC	1.471	-0.226	-0.466	1.050	-0.022	43.6%	2.25	-0.05	0.098	E
			(3.79)	(2.62)	(4.54)	(4.56)	(0.78)					
		CPI	1.516	-0.269	-0.470	1.060	-0.020	43.8%	2.26	-0.04		E
			(3.90)	(2.65)	(4.59)	(4.60)	(0.50)					
		XUVM	1.524	-0.294	-0.499	1.123	-0.108	44.0%	2.25	-0.22	0.042	E
			(4.03)	(2.52)	(4.63)	(4.65)	(1.72)					
	MG(M)	ULC	2.318	-0.162	-0.298	0.923	0.084	37.1%	3.10	0.28		A
			(4.83)	(1.54)	(3.59)	(3.51)	(2.02)					
		CPI	2.475	-0.145	-0.304	0.943	0.135	37.1%	3.10	0.44		A
			(5.14)	(1.18)	(3.75)	(3.67)	(2.25)					
		XUVM	2.326	-0.253	-0.220	0.685	0.086	34.7%	3.11	0.39		B
			(4.94)	(1.74)	(3.04)	(2.95)	(1.10)					

Table 5. France: Econometric Results from Estimating Equation (33)

Country	Variable	REER	Change In Income	Change In REER	Lagged Var Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
France	EGS	ULC	1.012	-0.364	-0.203	0.287	-0.192	31.8%	1.42	-0.95	0.043	C
			(1.45)	(4.13)	(2.43)	(2.33)	(2.60)					
		CPI	1.041	-0.292	-0.176	0.264	-0.069	18.6%	1.50	-0.39	0.018	D
			(1.31)	(2.36)	(1.96)	(2.02)	(1.04)					
		XUVM	1.480	-0.464	-0.179	0.281	-0.094	24.2%	1.57	-0.53	0.049	D
			(2.02)	(3.23)	(1.99)	(2.07)	(1.26)					
	EG	ULC	0.883	-0.325	-0.246	0.362	-0.152	27.5%	1.47	-0.62	0.057	C
			(1.24)	(3.51)	(2.72)	(2.65)	(2.03)					
		CPI	0.883	-0.161	-0.233	0.359	-0.041	14.1%	1.54	-0.18	0.022	D
			(1.11)	(1.25)	(2.45)	(2.51)	(0.63)					
		XUVM	1.122	-0.282	-0.253	0.397	-0.074	16.7%	1.57	-0.29	0.036	D
			(1.47)	(1.84)	(2.58)	(2.63)	(0.96)					
	EG(M)	ULC	0.722	-0.453	-0.254	0.339	-0.212	32.9%	1.34	-0.84	0.064	C
			(0.90)	(4.51)	(2.61)	(2.55)	(2.44)					
		CPI	0.867	-0.299	-0.210	0.304	-0.050	14.8%	1.45	-0.24	0.035	D
			(0.95)	(2.06)	(2.11)	(2.22)	(0.67)					
		XUVM	1.232	-0.467	-0.218	0.323	-0.079	19.0%	1.48	-0.36	0.067	D
			(1.43)	(2.75)	(2.18)	(2.28)	(0.93)					
	MGS	ULC	2.448	0.149	-0.164	0.329	0.163	22.9%	2.00	0.99		B
			(4.05)	(1.01)	(2.25)	(2.51)	(1.60)					
		CPI	2.353	0.042	-0.354	0.721	0.337	34.0%	2.04	0.95		A
			(4.63)	(0.27)	(4.31)	(4.45)	(3.65)					
		XUVM	1.807	-0.204	-0.431	0.790	0.473	43.4%	1.83	1.10		A
			(3.77)	(1.18)	(5.47)	(5.49)	(4.81)					
	MG	ULC	2.615	0.139	-0.167	0.331	0.168	21.8%	1.99	1.01		B
			(3.99)	(0.87)	(2.25)	(2.51)	(1.51)					
		CPI	2.559	0.035	-0.359	0.731	0.364	33.3%	2.03	1.01		A
			(4.62)	(0.21)	(4.25)	(4.40)	(3.61)					
		XUVM	1.973	-0.192	-0.452	0.820	0.531	43.1%	1.82	1.18		A
			(3.79)	(1.03)	(5.48)	(5.51)	(4.86)					
	MG(M)	ULC	3.464	0.284	-0.228	0.636	0.291	45.9%	2.79	1.28		A
			(6.72)	(2.24)	(2.97)	(3.19)	(3.31)					
		CPI	3.184	0.133	-0.363	1.007	0.302	48.2%	2.77	0.83		A
			(6.87)	(0.90)	(4.17)	(4.30)	(3.89)					
		XUVM	2.776	-0.183	-0.389	1.008	0.326	49.4%	2.59	0.84		A
			(5.99)	(1.07)	(4.78)	(4.78)	(3.94)					

Table 6. Italy: Econometric Results from Estimating Equation (33)

Country	Variable	REER	Change In Income	Change In REER	Lagged Var Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
Italy	EGS	ULC	1.722	0.006	-0.376	0.591	-0.004	18.4%	1.57	-0.01		B
			(1.45)	(0.05)	(3.98)	(3.78)	(0.07)					
		CPI	1.663	-0.034	-0.472	0.876	-0.192	22.3%	1.85	-0.41		B
			(1.42)	(0.16)	(4.41)	(3.87)	(1.67)					
		XUVM	1.693	0.011	-0.378	0.601	-0.027	18.4%	1.59	-0.07		B
			(1.46)	(0.05)	(4.02)	(3.73)	(0.24)					
	EG	ULC	3.704	0.003	-0.796	1.273	-0.178	37.0%	1.60	-0.22		B
			(2.06)	(0.01)	(6.47)	(6.21)	(1.75)					
		CPI	3.462	-0.036	-0.926	1.815	-0.512	44.2%	1.96	-0.55		A
			(2.02)	(0.12)	(7.39)	(6.81)	(3.28)					
		XUVM	3.070	-0.065	-0.832	1.426	-0.408	39.3%	1.71	-0.49		A
			(1.79)	(0.19)	(6.73)	(6.44)	(2.40)					
	EG(M)	ULC	3.818	-0.031	-0.808	1.426	-0.231	38.4%	1.77	-0.29		A
			(2.34)	(0.18)	(6.57)	(6.37)	(2.45)					
		CPI	3.368	-0.009	-0.859	1.791	-0.427	41.3%	2.08	-0.50		A
			(2.10)	(0.03)	(6.92)	(6.50)	(2.95)					
		XUVM	3.072	-0.068	-0.876	1.668	-0.529	42.7%	1.90	-0.60		A
			(2.01)	(0.22)	(7.13)	(6.91)	(3.33)					
	MGS	ULC	1.289	0.128	-0.267	0.453	0.196	17.9%	1.69	0.73		A
			(2.85)	(1.23)	(3.19)	(3.10)	(3.26)					
		CPI	1.172	-0.050	-0.187	0.202	0.196	14.4%	1.08	1.04		B
			(2.65)	(0.28)	(2.44)	(1.50)	(2.54)					
		XUVM	1.376	0.011	-0.274	0.408	0.270	13.0%	1.49	0.99		A
			(3.03)	(0.06)	(2.95)	(2.74)	(2.52)					
	MG	ULC	1.829	0.093	-0.513	0.813	0.244	22.8%	1.59	0.48		A
			(2.03)	(0.44)	(4.67)	(4.47)	(2.19)					
		CPI	1.854	-0.151	-0.458	0.629	0.170	19.3%	1.37	0.37		B
			(2.11)	(0.42)	(4.24)	(3.20)	(1.09)					
		XUVM	2.108	0.315	-0.585	0.823	0.472	24.1%	1.41	0.81		A
			(2.47)	(0.82)	(4.90)	(4.57)	(2.43)					
	MG(M)	ULC	2.127	-0.035	-0.592	1.523	0.270	28.3%	2.57	0.46		A
			(2.13)	(0.15)	(5.17)	(5.04)	(2.21)					
		CPI	2.379	-0.264	-0.567	1.304	0.264	26.7%	2.30	0.47		B
			(2.47)	(0.66)	(4.97)	(4.22)	(1.54)					
		XUVM	2.574	0.180	-0.628	1.513	0.466	27.9%	2.41	0.74		A
			(2.69)	(0.42)	(5.23)	(5.00)	(2.25)					

Table 7. Canada: Econometric Results from Estimating Equation (33)

Country	Variable	REER	Change In Income	Change In REER	Lagged Var Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
Canada	EGS	ULC	1.762	-0.269	-0.372	0.761	-0.046	28.7%	2.05	-0.12		B
			(2.80)	(2.13)	(3.78)	(3.72)	(1.17)					
		CPI	2.170	-0.209	-0.377	0.756	-0.059	26.1%	2.01	-0.16		B
			(3.40)	(1.45)	(3.77)	(3.72)	(1.20)					
		XUVM	2.300	-0.184	-0.361	0.677	-0.113	24.5%	1.88	-0.31		B
			(3.52)	(1.05)	(3.71)	(3.49)	(1.09)					
	EG	ULC	2.541	-0.313	-0.539	1.054	0.003	35.2%	1.96	0.01		E
			(3.85)	(2.46)	(4.96)	(4.90)	(0.08)					
		CPI	2.779	-0.257	-0.545	1.072	0.026	32.8%	1.97	0.05		E
			(4.15)	(1.76)	(4.95)	(4.92)	(0.55)					
		XUVM	2.945	-0.207	-0.524	1.022	0.005	30.4%	1.95	0.01		E
			(4.24)	(1.16)	(4.72)	(4.62)	(0.05)					
	EG(M)	ULC	3.209	-0.305	-0.676	1.509	-0.060	39.7%	2.23	-0.09		B
			(4.20)	(1.97)	(5.67)	(5.60)	(1.29)					
		CPI	3.506	-0.320	-0.654	1.450	-0.042	38.4%	2.22	-0.06		B
			(4.53)	(1.80)	(5.54)	(5.50)	(0.74)					
		XUVM	3.513	-0.341	-0.602	1.324	-0.022	37.8%	2.20	-0.04		B
			(4.47)	(1.63)	(5.35)	(5.21)	(0.18)					
	MGS	ULC	1.962	-0.005	-0.195	0.427	0.017	33.2%	2.20	0.09		B
			(5.16)	(0.04)	(2.51)	(2.74)	(0.44)					
		CPI	1.948	0.041	-0.201	0.446	0.027	33.4%	2.22	0.13		B
			(5.31)	(0.29)	(2.60)	(2.79)	(0.56)					
		XUVM	1.943	-0.014	-0.191	0.433	0.030	33.1%	2.27	0.16		B
			(5.26)	(0.08)	(2.53)	(2.58)	(0.31)					
	MG	ULC	2.323	-0.097	-0.101	0.211	0.039	27.6%	2.08	0.38		B
			(4.83)	(0.60)	(2.00)	(2.50)	(0.82)					
		CPI	2.329	-0.050	-0.117	0.252	0.076	28.4%	2.16	0.65		B
			(5.06)	(0.27)	(2.24)	(2.76)	(1.29)					
		XUVM	2.343	-0.079	-0.106	0.249	0.073	27.0%	2.35	0.69		B
			(5.04)	(0.36)	(2.03)	(2.20)	(0.60)					
	MG(M)	ULC	2.569	-0.028	-0.133	0.286	0.050	29.2%	2.15	0.37		B
			(5.21)	(0.17)	(2.39)	(2.73)	(1.03)					
		CPI	2.539	0.002	-0.152	0.341	0.091	30.5%	2.24	0.60		B
			(5.42)	(0.01)	(2.63)	(3.00)	(1.52)					
		XUVM	2.532	-0.105	-0.133	0.311	0.060	28.6%	2.35	0.45		B
			(5.33)	(0.47)	(2.30)	(2.30)	(0.48)					

instability, as revealed by the inclusion of the dummy terms, but that the equations would otherwise fall into the 'A' and 'B' categories respectively.

No one country's results are representative of the full group, and indeed the estimated equations for each country reveal idiosyncracies of interest. In our detailed discussion of the results we shall focus on three countries, the United States, France and Canada; these provide, respectively an example of uniformly good performance of all three alternatives, a noticeably superior/inferior performance by one measure, and an example where the relatively simplistic modelling approach adopted is perhaps less than ideal.

The results for the United States are encouraging in that they correspond with the theory behind the trade model used (i.e., elasticities are of expected sign and approximate magnitude), but less than useful in providing insights into the appropriate proxy measure of the real exchange rate. 1/ For exports, with the exception of one case with a marginally low significance level on the lagged level of export volume, every equation is graded 'A', with the lagged REER terms all significantly negative. The impact elasticities of the real exchange rate are all approximately zero which accords with the low speed of adjustment to long-term equilibrium (estimates of β_3 are around 0.12). The implied elasticities are all plausible, though there is quite a range of variation. 2/ There is also a clear tendency for the REER computed with export unit values (XUVM) to return high elasticities, and for the unit labor cost measure to give low elasticities. Table 8 details the coefficient of variation of, and correlations between, the REER measures. Since the only variable that is changing in our equation is the REER term, the changing elasticities at least partially reflect the variability ordering of these terms. Within each level of export aggregation, the fit of the equations, as given by the adjusted R^2, is comparable across REER measures, marginally favoring XUVM.

For U.S. imports, the picture is even more uniform. All variables are significant and signed as expected (except the current change in the real exchange rate which is always insignificant). Elasticities are comparable, although now $REER_{XUVM}$ produces the lowest income elasticity and ULC the highest. The estimated elasticities are within the range obtained by previous researchers and surveyed in Hooper and Marquez (1993). We also note that the income elasticities are higher for imports than exports, which is consistent with the asymmetry noted by Houthakker and Magee (1969). To

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1/ This is not surprising when we look at the correlations between the various REER terms reported in Table 10. For the United States these lie between 0.853 (XUVM/ULC) 0.981 (ULC/CPI).

2/ It would be interesting to evaluate the implications the measured elasticities have for the Marshall-Lerner condition, but this issue is beyond the scope of the paper.

Table 8. Correlations Between REER Measures

		ULC	CPI	Coefficient of Variation
United States	ULC	--	--	0.0369
	CPI	0.981	--	0.0296
	XUVM	0.847	0.894	0.0267
Germany	ULC	--	--	0.0238
	CPI	-0.304	--	0.0139
	XUVM	0.620	0.502	0.0106
Japan	ULC	--	--	0.0305
	CPI	0.909	--	0.0348
	XUVM	0.799	0.662	0.0108
United Kingdom	ULC	--	--	0.0315
	CPI	0.973	--	0.0218
	XUVM	0.916	0.902	0.0149
France	ULC	--	--	0.0085
	CPI	0.661	--	0.0105
	XUVM	0.414	0.746	0.0077
Italy	ULC	--	--	0.0136
	CPI	0.367	--	0.0201
	XUVM	0.505	0.754	0.0105
Canada	ULC	--	--	0.0233
	CPI	0.858	--	0.0174
	XUVM	0.223	0.643	0.0198

Notes: The first two columns of figures give the correlation between the different REER measures. The final column gives the coefficient of variation of the REER measures.

summarize, for the United States we can find no compelling reason to choose one measure of the real exchange rate ahead of any other. 1/

French exports tell a different story. Unless the REER term is computed with unit labor costs, the equations perform badly: the fit is poor, long-run equilibrium is poorly determined and the real exchange rate term is insignificant. Using unit labor costs, the model performs well and the elasticities are plausible. The ULC models also show short-run REER-elasticities of around -0.35 which are significant. The dummy terms were significant in all of the export equations, indicating a shift in the REER parameters. However, re-estimating the same model over the 1979-91 period (i.e., the ERM years) results in slightly higher REER elasticities but no hint of instability. The unit labor cost measure is, if anything, even more significant as shown in Table 9. We hypothesize that the shift is more connected to the operation of the ERM than to the behavior of the competitiveness proxies.

While the ULC measure can be recommended for exports, this is not the case for French imports. For the two broader categories of imports, the ULC real effective exchange rate term is insignificant and the fit is noticeably worse than those of the alternatives.

When we look at Canada the situation appears to have deteriorated even further. For both imports and exports, the long-run effects of the competitiveness terms are indistinguishable from zero. However, some improvement can be made by focusing on the bilateral trade between Canada and the United States. 2/ Trade between the two constitutes around 75 percent of Canada's total trade. The real effective exchange rates are weighted according to trade flows but with adjustments made to account for third market effects. This may be inappropriate for Canada. Replacing the foreign income term in the export equation with U.S. GDP, and calculating bilateral real exchange rates rather than effective rates produces the results given in Table 10. The export equations in particular are much improved. For goods and services, all three measures fit reasonably well and are significant, though the estimated REER elasticities are quite different from each other. As the level of disaggregation rises, a REER based on export unit values of manufactured goods performs best. Fit and significance increase, while the REER elasticities fall. Unfortunately the

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1/ Returning briefly to the results of our experimentation with cointegration, we note that for the United States, the individual REER terms did not cointegrate with each other, indicating different long-term properties. However, practically all combinations of imports (exports), domestic (foreign) income and a relative price term cointegrate with correctly signed vectors. Interestingly, the two examples which do not cointegrate (ULC and XUVM for imports of manufactured goods) appear stationary if plotted and give elasticities very close to those obtained in the simple regressions.

2/ The authors would like to thank Tamim Bayoumi for suggesting this modification, along with several other helpful comments.

Table 9. France: Econometric Results from Estimating Equation (33)

(ERM Sample Period)

Country	Variable	REER	Change In Income	Change In REER	Lagged Var Level	Lagged Income	Lagged REER	RBARSQ	Income Elasticity	REER Elasticity	Shift	Key
France	EGS	ULC	-0.58	-0.36	-0.43	0.53	-0.52	33%	1.23	-1.20		A
			(0.60)	(2.65)	(3.87)	(3.62)	(4.10)					
		CPI	0.45	-0.32	-0.18	0.27	-0.08	12%	1.51	-0.44		B
			(0.35)	(1.85)	(1.56)	(1.68)	(0.90)					
		XUVM	1.21	-0.56	-0.16	0.27	-0.10	18%	1.69	-0.66		B
			(1.12)	(2.74)	(1.49)	(1.68)	(1.16)					
	EG	ULC	-0.50	-0.27	-0.44	0.58	-0.46	28%	1.31	-1.03		A
			(0.46)	(1.79)	(3.65)	(3.43)	(3.52)					
		CPI	0.41	-0.21	-0.24	0.36	-0.06	9%	1.53	-0.25		B
			(0.30)	(1.10)	(1.94)	(2.03)	(0.66)					
		XUVM	0.92	-0.37	-0.23	0.38	-0.08	12%	1.61	-0.34		B
			(0.76)	(1.67)	(1.96)	(2.05)	(0.83)					
	EG(M)	ULC	-0.99	-0.34	-0.43	0.51	-0.50	25%	1.20	-1.18		A
			(0.80)	(1.97)	(3.44)	(3.22)	(3.35)					
		CPI	0.06	-0.28	-0.22	0.33	-0.07	8%	1.47	-0.31		B
			(0.04)	(1.34)	(1.81)	(1.96)	(0.70)					
		XUVM	0.81	-0.55	-0.21	0.33	-0.10	13%	1.58	-0.47		B
			(0.60)	(2.18)	(1.77)	(1.95)	(0.92)					
	MGS	ULC	2.05	0.36	-0.27	0.61	0.19	31%	2.28	0.71		B
			(3.79)	(1.96)	(3.06)	(3.26)	(1.32)					
		CPI	2.16	0.46	-0.62	1.36	0.50	48%	2.17	0.80	0.04	C
			(4.57)	(2.68)	(5.12)	(5.19)	(4.07)					
		XUVM	1.59	-0.04	-0.56	1.08	0.49	44%	1.94	0.87	0.03	C
			(3.17)	(0.20)	(5.08)	(5.16)	(3.88)					
	MG	ULC	2.21	0.38	-0.25	0.58	0.18	30%	2.32	0.73		B
			(3.69)	(1.88)	(2.86)	(3.08)	(1.15)					
		CPI	2.35	0.49	-0.58	1.27	0.51	44%	2.19	0.87		A
			(4.40)	(2.54)	(4.63)	(4.75)	(3.64)					
		XUVM	1.76	0.00	-0.57	1.09	0.55	42%	1.92	0.97	0.03	C
			(3.19)	(0.01)	(4.85)	(4.95)	(3.77)					
	MG(M)	ULC	2.89	0.42	-0.41	1.19	0.35	50%	2.89	0.85		A
			(6.40)	(2.80)	(3.49)	(3.57)	(2.63)					
		CPI	3.03	0.34	-0.70	1.95	0.41	60%	2.79	0.59		A
			(7.43)	(2.30)	(4.90)	(4.91)	(4.28)					
		XUVM	2.53	-0.12	-0.65	1.70	0.42	58%	2.61	0.64		A
			(6.06)	(0.69)	(5.57)	(5.52)	(4.50)					

Table 10. Canada: Econometric Results from Estimating Equation (33)

(Bilateral Model with the United States)

Country	Variable	RER	Change In Income	Change In RER	Lagged Var Level	Lagged Income	Lagged RER	RBARSQ	Income Elasticity	RER Elasticity	Shift	Key
Canada	EGS	ULC	1.408	-0.394	-0.419	0.952	-0.074	37.0%	2.27	-0.18		A
			(3.97)	(2.56)	(4.14)	(4.16)	(2.07)					
		CPI	1.610	-0.273	-0.486	1.060	-0.136	34.2%	2.18	-0.28		A
			(4.44)	(1.33)	(4.34)	(4.31)	(2.53)					
		XUVM	1.538	-0.330	-0.665	1.288	-0.321	41.1%	1.94	-0.48		A
			(4.49)	(1.91)	(5.34)	(5.30)	(3.85)					
	EG	ULC	1.706	-0.419	-0.464	0.997	-0.017	34.3%	2.17	-0.04		B
			(4.32)	(2.52)	(4.27)	(4.28)	(0.52)					
		CPI	1.837	-0.229	-0.459	0.969	-0.023	28.6%	2.11	-0.05		B
			(4.47)	(1.02)	(4.06)	(4.03)	(0.49)					
		XUVM	1.983	-0.284	-0.545	1.074	-0.135	33.1%	1.97	-0.25		B
			(4.97)	(1.51)	(4.61)	(4.52)	(2.02)					
	EG(M)	ULC	2.279	-0.434	-0.721	1.767	-0.078	46.0%	2.45	-0.11		A
			(5.27)	(2.30)	(5.90)	(5.88)	(2.03)					
		CPI	2.411	-0.423	-0.711	1.710	-0.096	43.1%	2.41	-0.14		B
			(5.44)	(1.65)	(5.61)	(5.57)	(1.80)					
		XUVM	2.532	-0.499	-0.716	1.629	-0.176	46.9%	2.28	-0.25		A
			(5.90)	(2.42)	(5.90)	(5.84)	(2.38)					
	MGS	ULC	2.011	-0.016	-0.243	0.519	0.052	35.2%	2.14	0.21		B
			(5.34)	(0.09)	(2.87)	(3.09)	(1.42)					
		CPI	1.966	0.005	-0.261	0.574	0.085	36.1%	2.20	0.33		B
			(5.47)	(0.02)	(3.09)	(3.27)	(1.70)					
		XUVM	1.991	-0.011	-0.273	0.655	0.138	37.1%	2.40	0.51		B
			(5.55)	(0.06)	(3.27)	(3.45)	(1.95)					
	MG	ULC	2.410	-0.101	-0.132	0.255	0.061	28.7%	1.93	0.46		B
			(4.94)	(0.46)	(2.21)	(2.71)	(1.30)					
		CPI	2.439	-0.112	-0.179	0.358	0.139	31.0%	2.00	0.78		B
			(5.37)	(0.43)	(2.78)	(3.19)	(1.98)					
		XUVM	2.459	0.015	-0.180	0.416	0.168	28.6%	2.31	0.93		B
			(5.27)	(0.06)	(2.27)	(2.35)	(1.38)					
	MG(M)	ULC	2.652	-0.057	-0.164	0.337	0.066	30.5%	2.05	0.40		B
			(5.26)	(0.26)	(2.59)	(2.94)	(1.43)					
		CPI	2.683	-0.089	-0.211	0.453	0.143	32.9%	2.15	0.68		A
			(5.73)	(0.33)	(3.10)	(3.39)	(2.08)					
		XUVM	2.632	-0.068	-0.167	0.396	0.095	29.0%	2.37	0.57		B
			(5.41)	(0.27)	(2.15)	(2.13)	(0.85)					

improvement is less evident for imports, where the relative price terms still have largely no effect.

The results for the other countries are equally equivocal. Typically, either none of the three measures works well, or all of them do. An unscientific tally of grades over all countries 1/ shows that XUVM leads by a short head in the 'A' count (26 versus 23 for ULC and 22 for CPI) but is more prone to errors than ULC (six 'D's and 'E's against just two). This comparability across measures is not surprising when we note that the swings in the real exchange rates are in many cases dominated by nominal changes. Using different price indices to deflate nominal exchange rates only slightly alters the patterns. Indeed, limited experimentation shows that the nominal effective exchange rate performs very much in line with our real measures.

V. Model Comparison

Since the simple diagnostics and elasticities of the equations seem insufficient to distinguish between alternative indicators, we carry out non-nested hypothesis tests. Our interpretation of the non-nested tests is slightly different from usual since we are not trying to test the validity of a certain model against an alternative specification. Rather, we wish to know whether one of our indicators, say $REER_{CPI}$, captures all the information relevant to, say, French exports of goods and services, contained in another indicator (e.g., $REER_{ULC}$) and can add further information. Loosely speaking, we wish to know whether $REER_{CPI}$ encompasses $REER_{ULC}$. Our chosen procedure is the J-test of Davidson and MacKinnon (1981). It is implemented for our example as follows. We first take the fitted values from the estimations of the French exports equation (33) using $REER_{CPI}$ and $REER_{ULC}$, and denote them f_{CPI} and f_{ULC} respectively. Equation (33) is then re-estimated using $REER_{ULC}$ but with f_{CPI} included as an additional regressor. Similarly, f_{ULC} is included in the re-estimation of the $REER_{CPI}$ formulation. The significance of each additional regressor is determined through a standard t-test. There are four possible combinations in this pair-wise comparison: (1) f_{CPI} is significant but f_{ULC} is not; (2) f_{ULC} is significant but f_{CPI} is not; (3) neither are significant; or (4) both are significant. In beauty contest fashion we will discuss these in reverse order. In case (4) when both are significant, we conclude that both $REER_{ULC}$ and $REER_{CPI}$ capture useful information regarding French exports not included in the other, and hence that neither dominates the other. In case (3), when both are insignificant, $REER_{ULC}$ and $REER_{CPI}$ capture essentially the same information, but again neither can be said to dominate the other. Cases (1) and (2) allow us to rank the indicators. When f_{ULC} is significant but f_{CPI} is not (case (2)), $REER_{ULC}$ adds information to that contained in $REER_{CPI}$, but not vice versa. Here we conclude that $REER_{ULC}$ dominates $REER_{CPI}$. If case (1) holds our conclusion is of course reversed.

1/ Using the U.S. bilateral results for Canada.

The results of such pair-wise comparisons are presented in Table 11. A ✓ in cell (i,j,k) indicates that the inclusion of the fitted value derived using indicator i is significant at the five percent level when included in the equation for trade flow k using indicator j. 1/ For Canada, the bilateral model with the U.S. is used in each case.

For ease of interpretation we have included a summary of the results in Table 12. Indicator Y is defined as "best" for a given category of trade flow if fitted values calculated using $REER_Y$ are significant when included in both of the other two equations and neither of the other two fitted value series are significant when included in the equation based on $REER_Y$. In other words, an indicator must dominate both of the alternatives to be classed as "best". Analogously, indicator Z is defined as "worst" if both of the other two fitted value series have explanatory power in its equation but fitted values based on $REER_Z$ have no explanatory power in either of the other equations. When there is no pattern of dominance or inferiority no entry is given.

In 17 of the 42 cases we can choose one indicator above all others. In ten cases we can reject one indicator as clearly inferior. The results support those based on the diagnostics-based analysis above. In the case of French trade flows, for example, the non-nested tests confirm the dominance of the unit labor cost measure when analyzing exports, and its failure when looking at imports. However, they also allow us to be a little more precise. Though we had no reason to choose one indicator ahead of another for U.S. exports, largely because of very high correlations between REER measures, the results of the J-tests indicate that at two out of three levels of aggregation export unit values are dominant.

We should not stress the positive results of this exercise too much. In 25 cases we have no clear indication of dominance, and in 20 cases (i.e., practically half) we can neither favor one indicator nor exclude another. It would appear that in many cases the three alternative indicators are either capturing essentially the same information (case(3)-type results) or are each telling a different, though possibly overlapping, part of the story (case(4)-type results).

VI. Conclusions

The results our analysis show that none of the indicators tested fully captures all of the theoretical aspects of competitiveness, and that on the empirical side, none of the indicators works well uniformly across countries. We are unable to unequivocally recommend one indicator above all others for use in every G-7 country to explain both import and export flows at all levels of aggregation. Therefore, we cannot elevate one indicator to the status of *the best* indicator.

1/ See notes to table for further explanation.

Table 11a. Results from Non-Nested Hypothesis: Export Equations

	ULC			CPI			XUVM		
	EGS	EG	EG(M)	EGS	EG	EG(M)	EGS	EG	EG(M)
United States									
ULC	--	--	--	×	×	×	×	×	×
CPI	×	×	×	--	--	--	×	×	×
XUVM	✓	×	✓	✓	✓	✓	--	--	--
Germany									
ULC	--	--	--	✓	✓	✓	×	✓	✓
CPI	×	×	×	--	--	--	×	×	×
XUVM	×	×	×	×	✓	✓	--	--	--
Japan									
ULC	--	--	--	×	×	×	✓	×	×
CPI	×	×	×	--	--	--	✓	×	×
XUVM	×	✓	✓	×	✓	✓	--	--	--
United Kingdom									
ULC	--	--	--	×	×	✓	×	×	✓
CPI	✓	×	×	--	--	--	✓	×	×
XUVM	×	×	×	×	×	×	--	--	--
France									
ULC	--	--	--	✓	✓	✓	✓	✓	✓
CPI	×	×	×	--	--	--	×	×	×
XUVM	×	×	×	✓	×	×	--	--	--
Italy									
ULC	--	--	--	×	×	×	×	×	×
CPI	✓	✓	×	--	--	--	×	✓	✓
XUVM	×	×	✓	×	×	✓	--	--	--
Canada									
ULC	--	--	--	×	✓	×	✓	✓	×
CPI	×	×	×	--	--	--	×	×	×
XUVM	✓	✓	✓	✓	✓	✓	--	--	--

Notes: The table is read as follows: The ✓ in the XUVM of the U.S. segment under the EGS column of ULC indicates that including fitted values of U.S. exports of goods and services computed with REER--XUVM is significant when included in the comparable equation using REER--ULC. The × in the same row under the EG column of ULC indicates that the REER--XUVM fitted values for the export of goods were not significant when included in the REER--ULC model.

Table 11b. Results from Non-Nested Hypothesis Tests: Import Equations

	ULC			CPI			XUVM		
	MGS	MG	MG(M)	MGS	MG	MG(M)	MGS	MG	MG(M)
United States									
ULC	--	--	--	✓	×	×	✓	✓	×
CPI	✓	✓	×	--	--	--	×	×	×
XUVM	✓	✓	✓	✓	✓	✓	--	--	--
Germany									
ULC	--	--	--	×	×	✓	×	×	✓
CPI	×	×	×	--	--	--	×	×	×
XUVM	×	×	✓	×	×	×	--	--	--
Japan									
ULC	--	--	--	×	×	×	✓	✓	✓
CPI	×	×	×	--	--	--	✓	×	✓
XUVM	×	×	×	×	×	×	--	--	--
United Kingdom									
ULC	--	--	--	NA	NA	×	NA	NA	×
CPI	NA	NA	×	--	--	--	NA	NA	×
XUVM	NA	NA	×	NA	NA	×	--	--	--
France									
ULC	--	--	--	×	×	×	×	×	✓
CPI	✓	✓	✓	--	--	--	×	×	×
XUVM	✓	✓	✓	✓	✓	×	--	--	--
Italy									
ULC	--	--	--	✓	✓	×	✓	×	×
CPI	×	×	×	--	--	--	×	×	×
XUVM	×	×	×	×	✓	×	--	--	--
Canada									
ULC	--	--	--	×	×	✓	×	×	×
CPI	×	✓	✓	--	--	--	×	×	×
XUVM	×	×	×	×	×	×	--	--	--

Notes: The ✓ in the CPI row of the U.S. segment under the MGS column of ULC indicates that including fitted values of U.S. imports of goods and services computed with REER-CPI is significant when included in the comparable equation using REER-ULC. The × in the same row under the MGS column of XUVM indicates that the same fitted values were not significant when included in the REER-XUVM model. NA indicates that the model has already been rejected due to incorrectly signed REER elasticities.

Table 12. Summary of "Best" and "Worst" Indicators for Each Country

		EGS	EG	EG(M)	MGS	MG	MG(M)
United States	Best	XUVM	--	XUVM	--	--	XUVM
	Worst	--	--	--	--	--	--
Germany	Best	--	ULC	ULC	--	--	--
	Worst	--	CPI	CPI	--	--	--
Japan	Best	--	XUVM	XUVM	--	--	--
	Worst	XUVM	--	--	XUVM	--	XUVM
United Kingdom	Best	CPI	--	ULC	--	--	--
	Worst	--	--	--	--	--	--
France	Best	ULC	ULC	ULC	XUVM	XUVM	--
	Worst	CPI	--	--	ULC	ULC	--
Italy	Best	--	CPI	--	ULC	--	--
	Worst	--	--	--	--	CPI	--
Canada	Best	--	--	XUVM	--	--	--
	Worst	--	ULC	--	--	--	--

Our theoretical discussion highlighted the overlap in information that the three alternative measures are likely to pick up. If competitiveness changes are the result of shocks in the (heterogeneous) traded goods market, then all three indicators will be affected. Similarly, if the nominal exchange rate is shifting for reasons unrelated to price and cost structures, all measures (including the nominal effective exchange rate) will give similar indications. In many cases we were unable to favor or explicitly rule out one particular indicator for this very reason.

We also discussed the information that one indicator will reveal that is not picked up in the others. The relevance of this heterogeneity is clear from the non-nested test results where we often found that each indicator adds to the explanatory power of the others but that none are able to encompass the information of its competitors. From a policy point of view, the implications are clear--in examining an issue as complex as trade competitiveness, the use of one indicator is sub-optimal.

The empirical part of this study has concentrated on testing the ability of several real exchange rate series to explain a broad range of trade flows for the major economies. We have sought to make the coverage as comprehensive as possible, and in order to maintain comparability between trade flow measures, countries and indicators we have adopted a relatively simple econometric framework. Thus, though we feel that our results are robust, we have also left open many other avenues for investigating this problem. Most obviously, a more comprehensive modelling approach might be adopted, whereby price and volume equations for exports and imports are specified and may be tailored towards the country under investigation. An approach based on bilateral trade data may also prove worthwhile in a model of differentiated traded goods flows.

Further Comparisons of Competitiveness Indicators

This section contains the comparisons among indicators not included in the text. Specifically, it contains all bilateral comparisons of the relative price of traded to nontraded goods, unit labor costs in manufacturing, and the indicator based on profitability in the traded sector.

Consumer price indices and the relative price of traded to nontraded goods

Each consumer price index is an aggregation of the prices of both traded and nontraded goods and can be written:

$$RER_{CPI} = \frac{E\ CPI_H}{CPI_F} = \frac{E \prod_j P_j^{\alpha_j}}{\prod_j P_{j*}^{\alpha_{j*}}} = \frac{E\ P_T^{\alpha_T}\ P_N^{\alpha_N}}{P_{T*}^{\alpha_{T*}}\ P_{N*}^{\alpha_{N*}}} \tag{34}$$

where each α_j is the weight of good j in the index. Since each CPI is a function of all consumer prices, the ratio of domestic to foreign CPIs is of course not equal to the relative price of traded to nontraded goods. In fact, if $P_T = EP_T^*$, and $\alpha_T = \alpha_T^*$, then the ratio of CPIs reduces to a ratio of the prices of nontraded goods in the two countries, as noted above. Alternatively, it can be shown that:

$$RER_{CPI} = \frac{(P_N/P_T)^{\gamma}}{(P_{N*}/P_{T*})^{\gamma}} \tag{35}$$

if EP_T equals P_T^*, where γ is the weight of nontraded goods in the consumer price index and this weight is the same across countries. Even though consumer price indices are frequently used in the computation of real exchange rate indices, the main problem is that the consumer price index contains both traded and nontraded goods. Harberger (1986), Edwards (1989), and Kakkar and Ogaki (1993) suggest using a wholesale price index (WPI) as a proxy for the price of tradables since it contains mainly tradable goods, and the consumer price index as a proxy for the index of nontradables prices, as the CPI is heavily influenced by service activities. Overall, it is not possible to reach a definitive conclusion concerning the relative performance of consumer prices and the relative price of traded to nontraded as indicators of competitiveness as each has deficiencies. As shown in equation (35), the ratio of consumer price indices may approximate the ratio of the relative price of nontraded goods in each country when prices of traded goods are highly correlated. This is an advantage since a comparison of consumer price indices bears a relationship to a relative price that economic theory suggests is quite important.

Consumer prices and the measure of profitability

By examining equation (31), a real exchange rate based on consumer price indices does contain information on the profitability of producing traded goods, but not in the form given by equation (24) which defines the real exchange rate based on the ratio of unit labor costs in manufacturing to the ratio of value-added deflators. The ratio of CPIs contains information on the profitability of producing both traded and nontraded goods, so it encompasses more information than RER_{PRF}. This additional information is useful to the extent that developments in the nontraded sector have important implications for the traded sector. A rise in profitability in the nontraded sector may attract resources away from the traded sector and lead to greater output of nontraded goods and smaller output of traded goods, thereby affecting the external balance.

Comparison of export unit values with the price of traded to nontraded goods

Real exchange rates based on export unit values can be expressed as a function of the value-added price and the price of intermediate inputs for each country, as in equation (32). From examining equation (32), it is clear that a comparison of export unit values does not measure the price of traded to nontraded goods nor is this relative price imbedded in the comparison of export unit values.

Comparison of export unit values with the measure of profitability

An examination of equation (32) reveals that a comparison of export unit values includes information on profitability in the exportable sector at home relative to competitors. The real exchange rate based on profitability in the traded sector is more comprehensive than export unit values since the profitability measure includes information on importable sectors, which is directly relevant for assessing movements in the trade balance.

Comparison of unit labor costs and the price of traded to nontraded goods

The real exchange rate indicator based on normalized unit labor costs in manufacturing is given in equation (22). If the value-added functions in the manufacturing sectors were Cobb-Douglas, then equation (22) can be written:

$$RER_{ULC} = \frac{E\, ULC_{MANF}}{ULC^{*}_{MANF}} = \frac{E\, (W_T\, L_T)/V_T}{(W_{T^*} L_{T^*})/V_{T^*}} = \frac{E\, \alpha_{LT}\, PV_T}{\alpha_{LT^*}\, PV_{T^*}} \qquad (36)$$

where α_{Lj} is the share of labor income in value added in sector j. In this case, the real exchange rate index based on normalized unit labor costs is related to a comparison of value-added deflators in the manufacturing sectors across countries, adjusted by the labor share parameters. Clearly, the unit labor cost indicator does not give direct information on the internal relative price of traded to nontraded goods, which is a shortcoming because an analysis of labor costs across the traded and nontraded sectors has obvious implications for the allocation of labor across the two sectors and the output of traded and nontraded goods. Changes in the relative output of traded to nontraded goods will have important implications for the balance of trade.

Comparison of unit labor costs and the measure of profitability

Equation (22) which defines the real exchange rate measure based on normalized unit labor costs is not an indicator of profitability as given by RER_{PRF}. Unit labor costs in manufacturing are just one component of the cost of production and by themselves, are not necessarily an indicator of profitability, especially when the production process is comprised of intermediate inputs. Since the indicator based on unit labor costs may give misleading signals when there are changes in the prices of intermediate inputs, Lipshitz and McDonald (1991) propose using the indicator based on profitability. In this way, the profitability indicator possesses an advantage over the unit labor cost indicator.

Comparison of the price of traded to nontraded goods and profitability

Comparing the final consumer prices of traded and nontraded goods implicitly contains information on profitability in the two sectors. Using the price functions, the relative price of traded to nontraded goods can be written:

$$\frac{P_N}{P_T} = \frac{c_{VN}\ (ULC_N + profit_N) + c_N P_N + c_{TN} P_T}{c_{VT}\ (ULC_T + profit_T) + c_{NT} P_N + c_T P_T} \qquad (37)$$

so the relative price of traded to nontraded goods contains information on the relative profitability across the two sectors. The profitability measure proposed by Lipshitz and McDonald (1991) RER_{PRF}, however, focusses on the profitability of producing traded goods at home relative to traded goods abroad. As with the other measures, RER_{PRF} does not explicitly take into account developments in the economy's nontraded sector, which is important in assessing changes in the balance of trade. On the other hand, the relative price of traded to nontraded goods by itself does not capture important dynamic effects, such as changes in labor productivity.

Weighting Scheme and Data Sources

In attempting to evaluate the various alternative proxies for the real exchange rate we are concerned to conduct the experiment on a level playing field. Our three REER terms are computed using the same "foreign" country groups, with the same weights and over the same period. Out of necessity, this limits somewhat our country coverage as unit labor costs, CPIs and export unit values of manufactured goods are computed for relatively few countries, and even fewer on a quarterly basis. The partner country group from which the REERs are calculated comprise the following 15 countries: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, United Kingdom, and the United States.

The weights used are Information Notice System weights which reflect both the relative importance of a country's trading partners in direct bilateral trade relations and that resulting from competition in third markets. The weights are based on disaggregated trade data for manufactured goods and primary products covering the three year period 1980-82. For manufactured goods, distinction is made by type of good and market. Allowance can then be made at the disaggregated level for competition among various exporters in foreign markets (third market effects). These weights can be subdivided into two terms, one recognizing import competition and the other export competition. We could use these import and export weights in our separate equations rather than the composite trade weights but since we are looking for a single indicator of competitiveness this was felt to be inappropriate.

The trade volume statistics are taken from the OECD. Imports and exports of goods and services are calculated on a national accounts basis, while the trade in goods and manufactured goods are calculated on a balance of payments basis.

The national real GDP measures are taken from IMF-IFS. The export market demand measure is taken from the IMF-Surveillance Database and is calculated as the growth of real GDP in partner countries, with weights proportional to 1988-90 average exports (1988-89 or 1988 if more recent data unavailable). It is only available annually and was interpolated to a quarterly measure using the *RATS* DISTRIB.SRC procedure.

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