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REGIONAL EXCHANGE RATE INDEXES FOR THE UNITED STATES*

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ABSTRACT. In this paper we construct exchange rate indexes for the nine U.S. Bureau of the Census regions. The results indicate there are nontrivial differences between them and an identically created overall U.S. exchange rate index. The national index is cointegrated with only two of these regional indexes, and in a Granger sense, it is causing one regional index. In addition, our results indicate that two of the regional exchange rate indexes are interchangeable with the national index. These results show that researchers investigating how exchange rate changes affect regional exports or regional economic growth should be cautious in making inferences based upon a national exchange rate index.

1. INTRODUCTION

Exchange rate indexes have been crucial indicators of currency values since the advent of floating exchange rates in the early 1970s. These indexes summarize information contained in the many bilateral exchange rates that apply to a particular currency to gauge the average value of that currency against others. They are commonly used to make inferences concerning the effects of exchange rate changes on economic variables such as trade flows, foreign direct investment, and price levels. The U.S. is such a large country that a question exists regarding the usefulness of a single measure of the dollar for all purposes. This arose in terms of how an exchange rate index should be weighted: should weights be based on imports, exports, or the sum of the two? Secondly, which currencies should be included: all possible currencies or some more limited sample? These considerations led to the creation of subindexes for particular industries and for

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various regions of the world. Given this, it is logical to consider whether an exchange rate index for the U.S. is appropriate for analyses at the scale of the nine U.S. Bureau of the Census regions.[1]

Various researchers have considered the role of U.S. regions in international trade and the influence of the latter on the former. Fieleke (1986) and Coughlin and Cartwright (1987a, 1987b) have studied the foreign trade component of both state and regional economies. Because exports have important impacts on state and regional growth, several studies have looked at factors affecting a region's trade performance. See Coughlin and Cartwright (1987a, 1987b), Coughlin and Fobel (1988), Erickson (1989), and Erickson and Hayward (1991). In addition, Branson and Love (1986, 1987) find substantial differences in the effects of exchange rate movements on employment and output across U.S. manufacturing industries. Many U.S. industries tend to be regionally concentrated so industrial mixes vary widely across regions of the country. This variety suggests that regions may respond differently to a given change in the value of the dollar. Cox and Hill (1988) provide estimates of the effects of exchange rate changes on manufacturing output at the state level by industry. Carlino, Cody, and Voith (1990) estimate the effects of exchange rate changes on state output and economic growth. In international economics terms, this is equivalent to asking about the sensitivity of a region's exports or economic growth to changes in a national exchange rate index. A logical outgrowth of this research is to determine how factors external to the U.S. affect regional economies. A good example of an external factor which may differentially affect regions within the U.S. is the recent passage of the North American Free Trade Agreement (NAFTA). Also see Hayward (1995) who considers the effects of the expansion of the European Union (EU) on U.S. trade.

This type of research is necessary because of two obvious disparities among the various U.S. Bureau of the Census regions. First, the concentration of industries differs across region within the United States. According to Krugman (1991), regions of the U.S. differ more in terms of industrial mix than do the national economies of the European Union. Second, transportation costs lead regions to trade more heavily with some countries than with others, see Erickson and Hayward (1991). These considerations lead to the expectation that trade with foreign countries will differ considerably across the various U.S. regions. Table 1 illustrates the different foreign markets or export shares served by the nine Census regions of the U.S based on 1994 exports.[2]

[1]Hervey and Strauss (1996) construct similar but not identical regional exchange rate indexes based on durable, nondurable, and total manufacturing exports.

[2]The 1994 data was obtained from the U.S. Department of Commerce, Bureau of the Census, *U.S. Exports of Domestic and Foreign Merchandise by Origin of Movement*, machine-readable data file. The nine regions of the country are: New England with Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; Middle Atlantic with New Jersey, New York, Pennsylvania; East North Central with Illinois, Indiana, Michigan, Ohio, Wisconsin; West North Central with Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota; South Atlantic with Delaware, District

TABLE 1: Foreign Destination of Regional Exports, 1994 (Percentage Shares)

	Foreign Destination								
Region of the United States	Canada	Japan	Mexico	Europe	Africa	Rest of America	Oceania	Asia	Total*
East North Central	50.8	8.0	5.9	19.9	0.9	4.7	3.8	6.1	100.0
East South Central	30.0	10.1	7.8	26.1	0.9	10.9	5.7	8.5	100.0
Middle Atlantic	27.8	8.0	4.4	32.7	1.7	6.0	5.8	13.6	100.0
Mountain	12.7	14.2	16.6	29.7	0.5	2.9	11.4	11.9	100.0
New England	33.9	8.3	4.0	34.7	0.8	5.4	6.2	6.7	100.0
Pacific	11.7	22.1	8.2	25.1	0.7	4.3	13.0	15.0	100.0
South Atlantic	19.6	8.9	5.5	22.7	1.3	24.2	7.3	10.4	100.0
West North Central	35.2	12.9	8.2	23.0	1.1	5.5	5.7	8.3	100.0
West South Central	10.8	7.2	35.3	16.4	2.7	10.3	8.8	8.7	100.0
Total	24.6	11.5	10.9	24.6	1.3	8.2	7.8	11.1	100.0

*Note: Totals may not add to 100 due to rounding.

The importance of different trading partners for the U.S. in total and each of the regions appears to support the idea that regional exchange rate indexes might be different from one another. In particular, specific Census regions, because of proximity, lower transportation costs, or industrial mix, tend to engage in international trade with certain countries. For example, the East North Central is dominated by trade with Canada. The Pacific Region is dominated by trade with Japan, Oceania, and Asia. The West South Central Region is dominated by trade with Mexico and the South Atlantic Region trades mostly with countries in the Americas not including Mexico, and Canada.

When regions exhibit different international trade patterns, changes in the bilateral exchange rates may have different implications for the economies of these regions. This is particularly important because exchange rate changes are not uniform in magnitude across countries. In addition, the importance of different trading partners for the U.S. in total and each of the regions appears to be changing over time. In particular, Europe (Mexico) has become less (more) important for each of the regions within the U.S.

Our purpose is to construct exchange rate indexes for the nine U.S. Census regions. When constructing a national or regional exchange rate index, a sample of currencies should be selected that closely reflects the trade patterns of the country or region. Results below indicate that the various regional exchange rate indexes are in many cases nontrivially different from an overall U.S. index. The next section of the paper discusses issues involved in constructing an exchange rate index. Indexes and empirical tests are presented in the third and fourth sections respectively. A summary and some tentative conclusions are given in the final section.

2. CONSTRUCTION OF A REGIONAL EXCHANGE RATE INDEX

Several key issues are involved in the construction of an exchange rate index. The first issue concerns the choice of weights for the weighted average exchange rate index. There are in general three choices: an export weight, an import weight, or the sum of the two.[3] Trade data by state are based on information obtained from the Shipper's Export Declaration form so only export data are collected by state of shipment.[4] The region-specific weights used to construct the trade-weighted exchange rate are simply the share of each foreign country in each of the region's total exports. The construction of these share

of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia; East South Central with Alabama, Kentucky, Mississippi, Tennessee; West South Central with Arkansas, Louisiana, Oklahoma, Texas; Mountain with Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, and Pacific with Alaska, California, Hawaii, Oregon, Washington.

[3]A related issue is whether to use bilateral weights or multilateral weights. The usual choice in the literature is the former. For details on this issue see Kercheval (1987).

[4]Import data are collected not by state of ultimate destination, but by port of entry, which is not useful for our purposes.

weights uses data on state exports by country of destination from the U.S. Department of Commerce's "origin of exporter" series to obtain the destination country shares for each region. The share weights for each region's exports classified by country of ultimate destination are based on 1994 trade flows.[5] The second issue in the computation of an exchange rate index involves the time frame of the study. We have selected 1973:3 (which is the period when the U.S. "officially" left the Bretton Woods fixed exchange rate system) as the beginning of the data series and 1994:4 as the end; this issue is discussed in greater detail in Deyak, Sawyer, and Sprinkle (1989). A third issue involves the type of average to use. Trade-weighted exchange rates are typically constructed using a geometric average. We have followed that practice here.[6] Fourth, there is the question of which countries to include (exclude). A small sample of countries has the advantage of being easy to compute. However, exclusion of a significant portion of trade is troubling. Ideally, one might wish to include all countries, but the timeliness of data emanating from developing countries poses a problem. Given these trade-offs, we have included 50 countries in each index.[7] This group of countries covers approximately 91 percent of total U.S. exports. These countries were chosen based on the availability of data and their relative importance in both overall U.S. exports and each region's exports.

A fifth issue is the construction of a nominal exchange rate index versus a real exchange rate index. We have chosen the latter for several reasons. When exchange rates float they tend to deviate significantly from purchasing-power parity. A nominal exchange rate change unadjusted for relative inflation can be misleading. For example, the crawling pegs common in Latin America look like devaluations in nominal terms, but when adjusted for relative inflation differentials, many of these currencies are simply retaining their real value vis-à-vis foreign currencies.[8] As is common in the literature we have used the Producer Price Index as the inflation measure for the U.S. and where possible for each

[5]The Federal Reserve Bank of Dallas constructs its national exchange rates using a three-year moving-average for weights. However, given data limitations the indexes constructed in this study use fixed weights. Hervey and Strauss (1996) construct similar indexes using a 1993–1994 average of the location of exporter series. Calculations of the regional exchange rates and empirical results based on 1987 trade weights are available upon request. The statistical analysis indicates that the results based on 1994 weights presented in the paper can be generalized to the 1987 weights with minor differences.

[6]Advantages inherent in using the geometric mean to calculate the average value of the dollar are discussed in Coughlin and Pollard (1996) and Rosensweig (1987).

[7]Countries included in the exchange rate indexes are as follows: Algeria, Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Costa Rica, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Finland, France, Germany, Greece, Guatemala, Honduras, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Korea, Kuwait, Malaysia, Mexico, Netherlands, New Zealand, Norway, Panama, Peru, Philippines, Portugal, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, and Venezuela.

[8]Calculations of the nominal exchange index for the various regions look considerably more dramatic than the real indexes reported below. Plots of these nominal exchange rate changes are available upon request.

foreign country.[9] The foreign Consumer Price Index was used in cases where the Producer Price Index was not available.[10] The degree of aggregation used in the indexes is total merchandise exports. Optimally, one would like to include exports of services, but data concerning state or regional exports of services are not currently available.

Specifically, each regional exchange rate index is constructed on a quarterly basis as

$$E_t = 100\prod_{i=1}^{50}\left[\left(\frac{E_t^i P_t^{US}}{P_t^i}\right)\Big/\left(\frac{E_B^i P_B^{US}}{P_B^i}\right)\right]^{w^i} \tag{1}$$

where

E_t	=	the real dollar exchange rate index in period t
E_t^i	=	*the number of units of currency* i per dollar in period t
P_t	=	the wholesale price index in period t
B	=	the base period (1973.3)
w^i	=	the trade weight assigned country i based on its 1994 share of the total U.S. exports shipped from the Census region to the countries included in the index.

Bilateral exchange rates and domestic price indexes are constructed from information contained in an International Monetary Fund (1995) data file. Export figures by state and foreign destination are from a U.S. Bureau of the Census (1995) report, which records the value of export shipments by firms within states, rather than the (unknown) value of goods produced within states that are exported. Export values are biased toward states of exportation because there is a tendency for exports to be attributed to those states rather than to true states of production.[11] We expect to lessen this bias by aggregating states into larger Census regions.

3. REGIONAL EXCHANGE RATE INDEXES

Regional exchange rate indexes are presented in Figure 1 (Panels A–J). Regions covered are the East North Central (ENC), East South Central (ESC), Middle Atlantic (MATL), Mountain (MTN), New England (NE), Pacific (PAC), South Atlantic (SATL), the U.S. (TOTAL), West North Central (WNC), and West

[9]The Producer Price Index is the preferred measure of inflation in this literature as most Consumer Price Indexes contain a substantial number of nontradeable goods such as services.

[10]The Consumer Price Index was used for the following countries: Algeria, Dominican Republic, France, Guatemala, Honduras, Jamaica, Kuwait, Malaysia, Peru, Portugal, Saudi Arabia, Singapore, and Turkey. The GDP price deflator could be used as an alternative to the CPI. However, for the above countries the GDP price deflator was not available over the entire time frame of the study.

[11]See Coughlin and Mandelbaum (1991) for a discussion of the biases inherent in this data series.

South Central (WSC).[12] The general movement of the indexes is similar. All indexes depreciated somewhat in the 1970s and appreciated during the early 1980s. This peak is followed by a depreciation of all the indexes in the late 1980s and early 1990s. The magnitude and timing of the changes in the values of these indexes are similar but they are not identical. Descriptive statistics shown in Table 2 illustrate this point. The mean value of the indexes ranges from a high of 103.75 for WSC to 99.35 for PAC. The lowest value over the time series ranges from 83.37 for PAC to 93.49 for ENC. Analogous numbers for the highest value range from 128.31 for WSC to 119.29 for ENC. The mean, minimum, and maximum values for TOTAL are 101.33, 89.45, and 120.80, respectively. The standard deviations range from 7.05 (ENC) to 10.25 (MTN). This compares with a standard deviation for TOTAL of 8.15.

Table 2 also includes information concerning the importance of each region's exports relative to total exports. The dominant region is PAC with 23.2 percent of total U.S. exports. This region is followed in order by ENC (18.0 percent), WSC (15.9 percent), SATL (13.8 percent), and MATL (11.7 percent). These five regions account for approximately 83 percent of total U.S. exports. Four regions (ESC, MTN, NE, and WNC) are relatively small, each accounting for approximately 5 percent of total U.S. exports. Although regional exchange rate calculations are based on only 50 countries, the percentages of total regional exports covered by the exchange rates are quite high, ranging from 95.9 percent in the case of ENC to 89.5 percent for SATL.

Table 3 presents a correlation matrix for the various regional exchange rate indexes and the total exchange rate index. The highest correlation is 0.9928 between TOTAL and WNC. The lowest correlation is 0.8619 between TOTAL and WSC. The average correlation between TOTAL and the nine regions is .96. Although the correlations are quite high, subsequent tests indicate the regional exchange rates differ more than these figures suggest.

The plots and descriptive statistics show there are nontrivial differences between various regional exchange rate indexes and the total exchange rate index. Formal statistical tests are employed to more closely examine these differences. In addition, because we employ a fixed-weight index for all years, whereas the true trade weights are likely changing, and changing differently across regions, the following tests are likely biased against finding differences across regions. To begin with, each exchange rate index was tested for nonstationarity using the Augmented Dickey-Fuller (ADF) test (see Fuller, 1976; Mackinnon, 1991). The test for a unit root in each of the regional exchange rate indexes contained a constant term and four lagged difference terms. The test for a unit root in the case of first-differences contained only the four lagged difference terms. Results are provided in Table 4. In all cases, regional exchange

[12]A real exchange rate index for the U.S., analogous to the regional indexes, has been constructed for purposes of comparison both here and below.

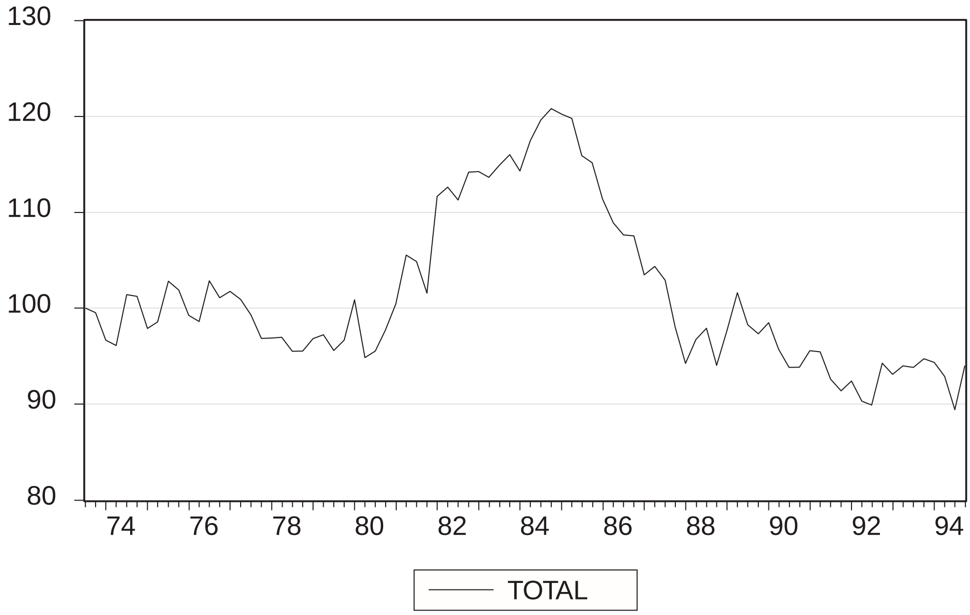

FIGURE 1a: Real Exchange Rate Index for TOTAL.

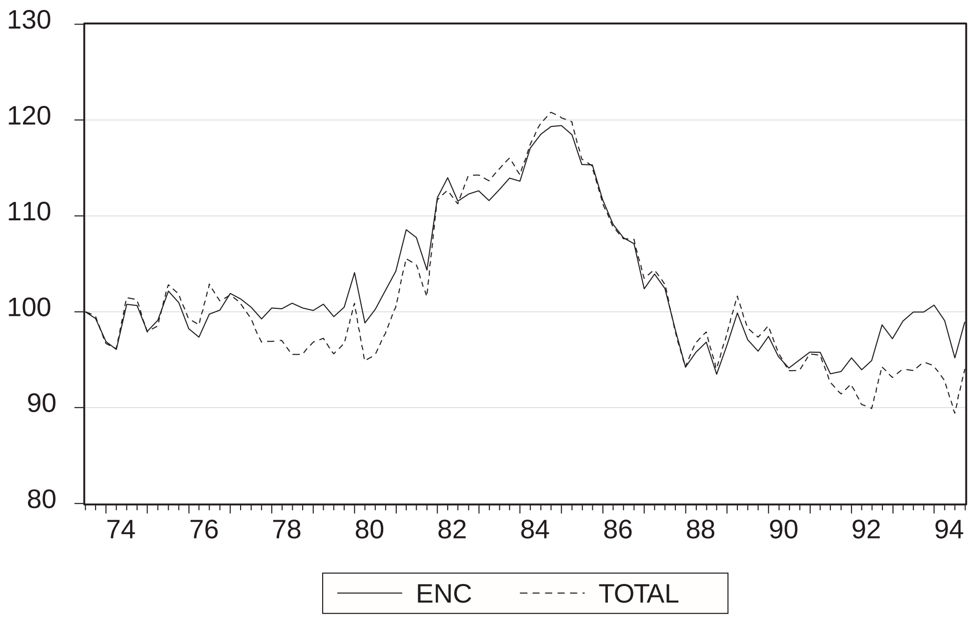

FIGURE 1b: Real Exchange Rate Indexes for East North Central States versus TOTAL.

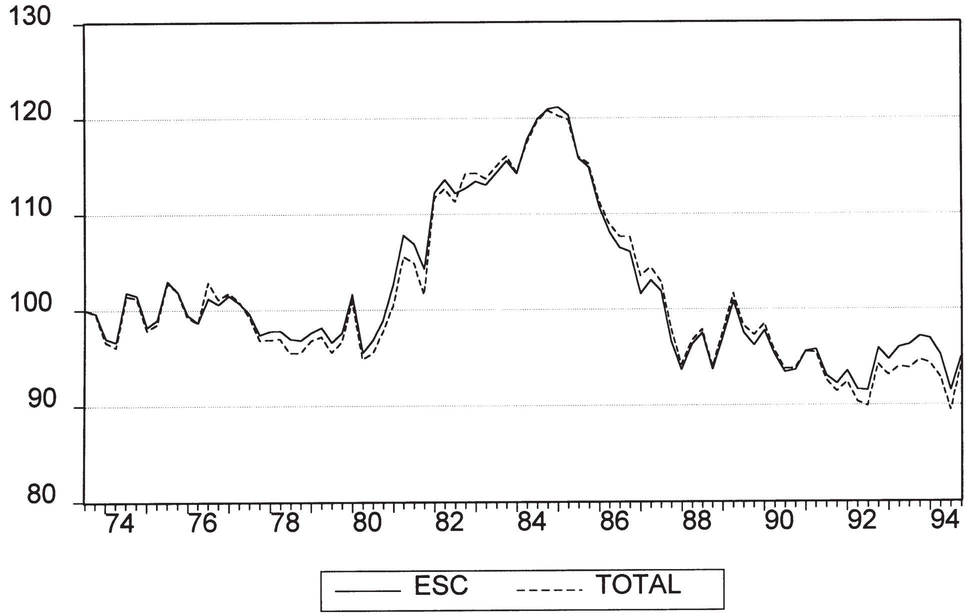

FIGURE 1c: Real Exchange Rate Indexes for East South Central States versus TOTAL.

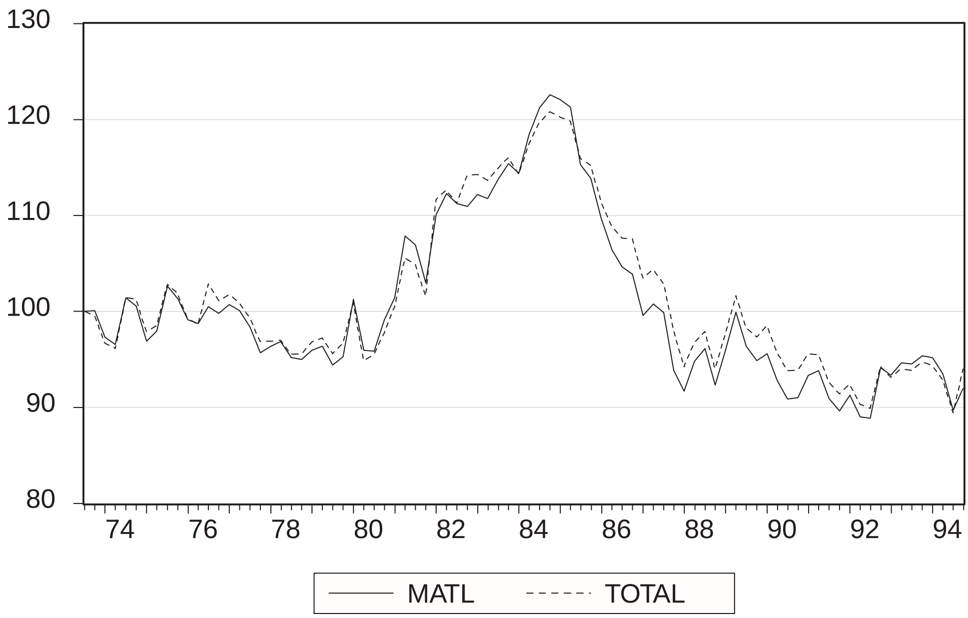

FIGURE 1d: Real Exchange Rate Indexes for Middle Atlantic States versus TOTAL.

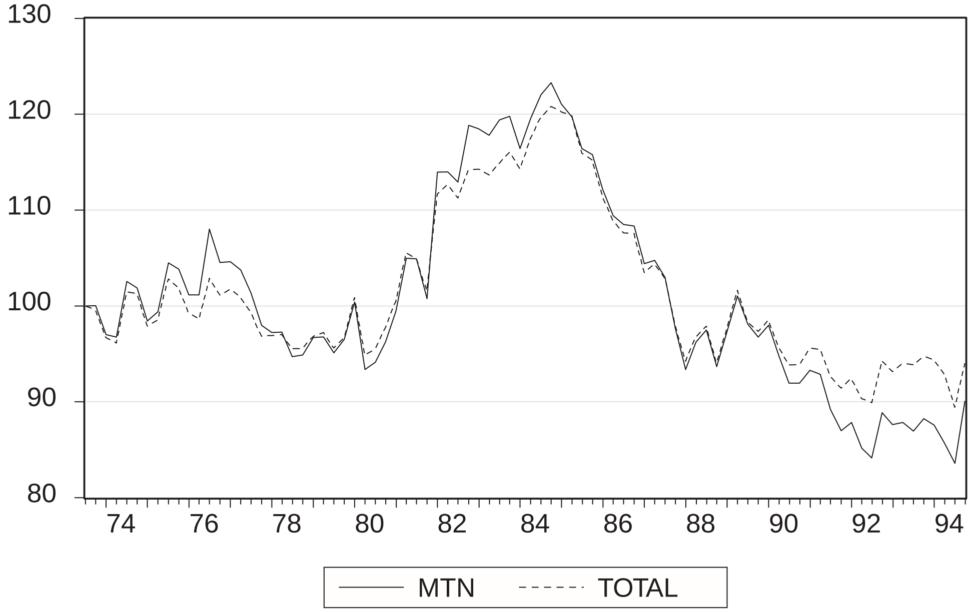

FIGURE 1e: Real Exchange Rate Indexes for Mountain States versus TOTAL.

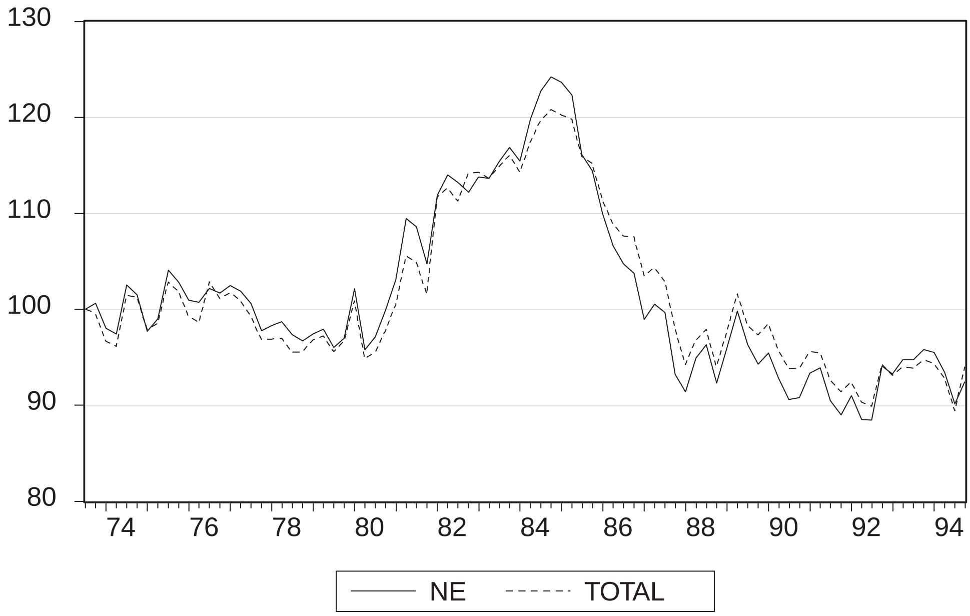

FIGURE 1f: Real Exchange Rate Indexes for New England States versus TOTAL.

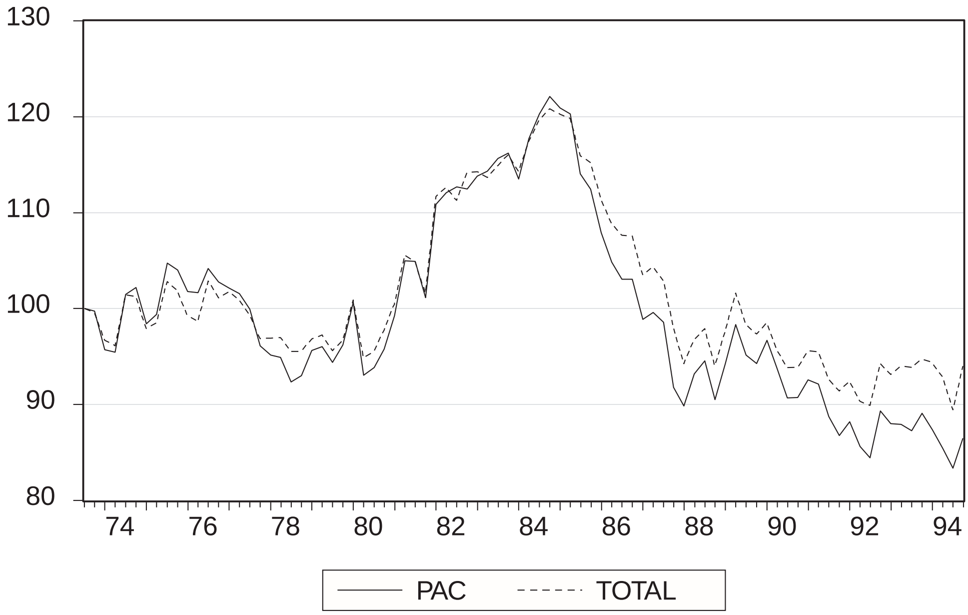

FIGURE 1g: Real Exchange Rate Indexes for Pacific States versus TOTAL.

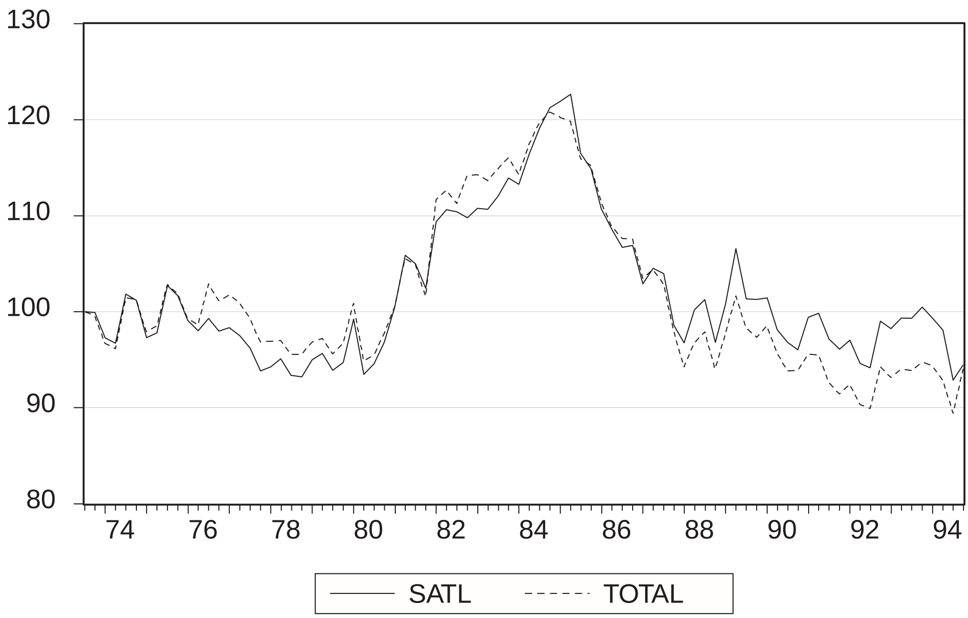

FIGURE 1h: Real Exchange Rate Indexes for South Atlantic States versus TOTAL.

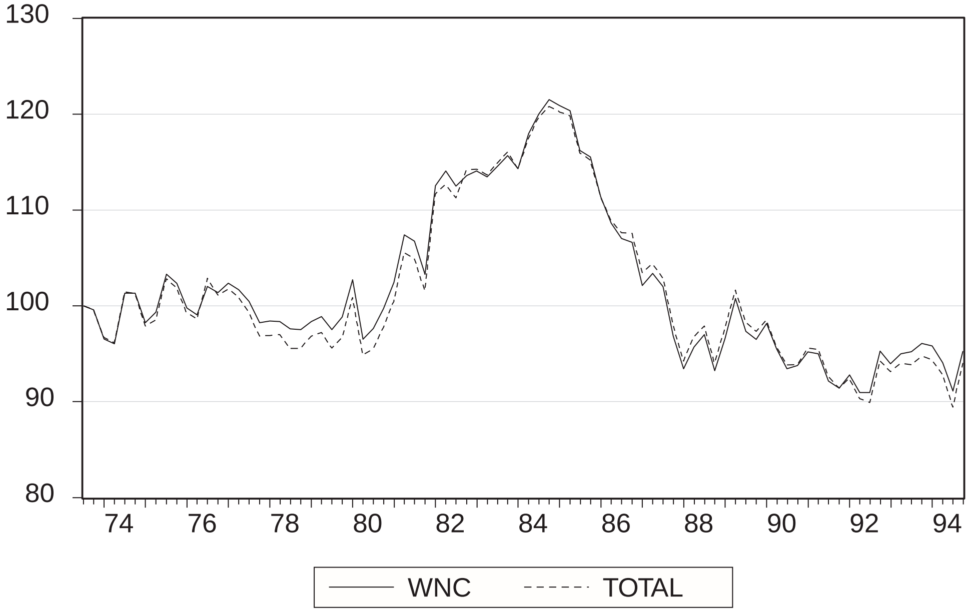

FIGURE 1i: Real Exchange Rate Indexes for West North Central States versus TOTAL.

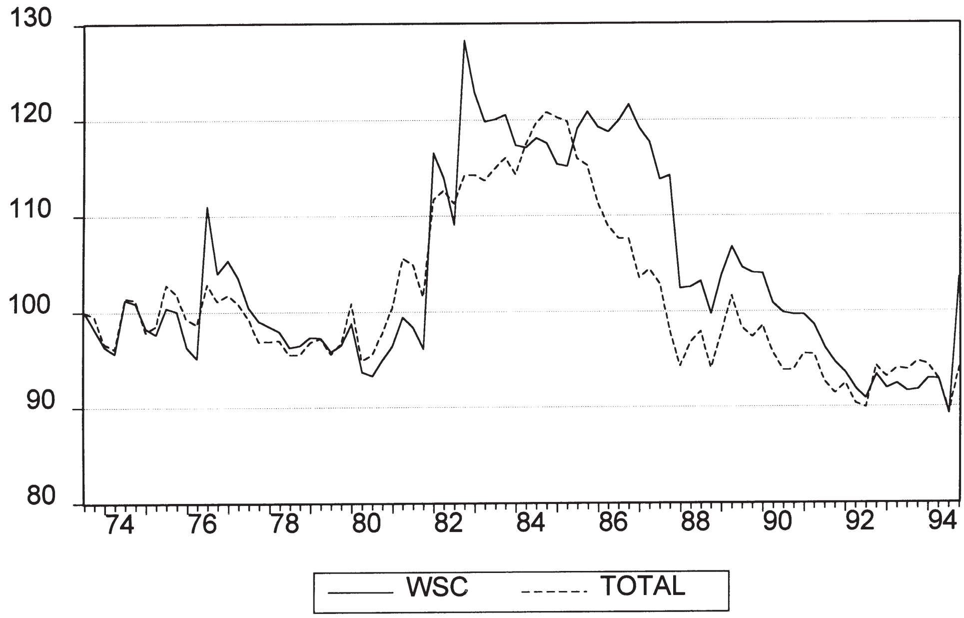

FIGURE 1j: Real Exchange Rate Indexes for West South Central States versus TOTAL.

TABLE 2: Descriptive Statistics

Region	TOTAL	ENC	ESC	MATL	MTN	NE	PAC	SATL	WNC	WSC
Mean	101.33	102.43	101.68	100.48	100.98	101.28	99.35	101.89	101.77	103.75
Maximum	120.80	119.29	121.16	122.57	123.27	124.22	122.10	122.66	121.51	128.31
Minimum	89.45	93.49	91.49	89.85	83.59	88.46	83.37	92.87	90.82	89.28
Standard Deviation	8.15	7.05	7.83	8.47	10.25	8.91	9.62	7.31	8.05	9.64
% of Total U.S. Exports	100.00	18.00	3.90	11.70	4.10	5.10	23.20	13.80	4.20	15.90
% of Exports Covered by Exchange Rate	92.10	95.90	93.40	94.10	92.70	95.70	89.80	89.50	94.40	90.90

TABLE 3: Correlation Matrix

	TOTAL	ENC	ESC	MATL	MTN	NE	PAC	SATL	WNC	WSC
TOTAL	1.0000									
ENC	0.9580	1.0000								
ESC	0.9917	0.9803	1.0000							
MATL	0.9847	0.9713	0.9955	1.0000						
MTN	0.9790	0.9020	0.9556	0.9522	1.0000					
NE	0.9758	0.9678	0.9902	0.9963	0.9523	1.0000				
PAC	0.9730	0.9109	0.9649	0.9699	0.9852	0.9744	1.0000			
SATL	0.9443	0.9043	0.9441	0.9362	0.8732	0.9079	0.8783	1.0000		
WNC	0.9928	0.9799	0.9974	0.9925	0.9661	0.9897	0.9721	0.9260	1.0000	
WSC	0.8619	0.7609	0.8019	0.7662	0.8678	0.7393	0.7814	0.7992	0.8123	1.0000

TABLE 4: Unit Root Tests

Regional Exchange Rate	Levels	First Differences
TOTAL	–1.608	–3.006**
ENC	–1.629	–3.026**
ESC	–1.676	–3.076**
MATL	–1.656	–2.977**
MTN	–1.582	–2.896**
NE	–1.683	–3.079**
PAC	–1.609	–3.118**
SATL	–1.793	–3.395**
WNC	–1.644	–3.045**
WSC	–2.015	–3.168**
5% Critical Value	–2.897	–1.944
1% Critical Value	–3.512	–2.592

**Significant at the .01 level.
*Significant at the .05 level.

rates are not stationary in level form. However, each of the regional exchange rates are stationary in first-differences.

Given that all of the regional exchange rate indexes are nonstationary, differences between the regional exchange rate indexes and the national (or another regional) index may be compared using cointegration analysis. Intuitively, if two variables are cointegrated they are following a common time trend and a linear combination of them is stationary. In general, the typical interpretation of the cointegrating equation is as a long-run equilibrium relationship between the two variables. Thus, if TOTAL and NE are following a common time trend, one could infer the factors influencing TOTAL and NE are not only the same but are affecting them in a similar time frame. According to Stock and Watson (1988), cointegration analysis can be used not only to check the reliability of time-series regressions but also to test for expected economic relationships. If the two indexes are *not* cointegrated, this would be evidence that TOTAL and NE are, at least to some degree, independent of one another. Any estimated relationship between the two indexes would have to be conducted after first-differencing.

We employ the Johansen test for cointegration based on the eigenvalues and likelihood ratios (for more detail about this text see Johansen, 1991). For each test of cointegration the estimated VARs contained a constant term and four lagged terms. Results are shown in Table 5. Only two of the nine regional exchange rate indexes (MATL and WSC) are cointegrated with TOTAL at the .05 level of significance. Although these results are not definitive, they do provide evidence that regional exchange rate indexes are different from TOTAL in an important way.

A second test of the relationship between TOTAL and the various regional exchange rate indexes involves determining whether one exchange rate may be causing changes in another exchange rate. In this case we have employed the

TABLE 5: Cointegration Analysis

Series		Eigenvalue	Likelihood Ratio
ENC	TOTAL	0.080843	10.91169
ESC	TOTAL	0.140989	15.11819
MATL	TOTAL	0.185363	18.57491*
MTN	TOTAL	0.069138	8.87108
NE	TOTAL	0.112044	11.81457
PAC	TOTAL	0.036480	4.87402
SATL	TOTAL	0.069648	8.63621
WNC	TOTAL	0.095508	13.35953
WSC	TOTAL	0.188678	19.14845*

Note: The 5% (1%) critical value for the likelihood ratio test is 15.41 (20.04).
*Significant at the .05 level.

TABLE 6: Granger Causality Tests

Region Granger Causes Region	F-Statistic	Region Granger Causes Region	F-Statistic
ENC vs. TOTAL	0.39344	TOTAL vs. ENC	0.16414
ESC vs. TOTAL	1.82653	TOTAL vs. ESC	0.98283
MATL vs. TOTAL	1.88007	TOTAL vs. MATL	0.50920
MTN vs. TOTAL	0.78124	TOTAL vs. MTN	0.71780
NE vs. TOTAL	2.58922*	TOTAL vs. NE	1.10468
PAC vs. TOTAL	1.28578	TOTAL vs. PAC	0.80856
SATL vs. TOTAL	0.78765	TOTAL vs. SATL	0.46628
WNC vs. TOTAL	0.95516	TOTAL vs. WNC	0.73398
WSC vs. TOTAL	1.70400	TOTAL vs. WSC	4.62578**

**Significant at the .01 level.
*Significant at the .05 level.

standard Granger-Causality tests with four lagged terms to investigate whether changes in TOTAL are causing the regional exchange rate indexes to change, or if changes in a regional exchange rate cause the TOTAL index to change. Results are presented in Table 6. In the sense of the test TOTAL does cause changes only in the WSC index, and only the NE index causes changes in TOTAL.

A final test of the relationship between TOTAL and the various regional exchange rate indexes is to determine if the exchange rate indexes are interchangeable as explanatory variables in regression analysis. For interchangeability two variables must not only be highly correlated but they must also consistently differ by no more than an additive constant. This difference preservation is known as an orthogonal regression criterion.[13] Jackson and Dunlevy

[13]In contrast to simple regression, the estimated regression line in orthogonal regression is the one that minimizes the mean squared error of the perpendicular deviation of the individual observations from the estimated regression line. See Malinvaud (1980) for a discussion of the difference between orthogonal and simple regression.

TABLE 7: Orthogonal Regression Analysis (Dependent Variable Total)

Region	Parameter Estimates		χ^2 Test
	Constant	Slope	
ENC	13.2670	0.8597	22.203**
ESC	3.6176	0.9610	8.087**
MATL	–3.2262	1.0423	4.0340*
MTN	–26.3667	1.2645	112.508**
NE	–9.7102	1.0964	14.564**
PAC	–16.4484	1.1854	45.014**
SATL	10.4559	0.8918	9.343**
WNC	0.8263	0.9876	0.929
WSC	–29.2084	1.2581	13.504**

**Significant at the .01 level.
*Significant at the .05 level.

(1981, 1982) illustrate the interchangeability of two variables using different measures of permanent income. In our context, assume, for example, perfect correlation between a regional exchange rate (NE) and the national exchange rate (TOTAL), so that

$$\text{TOTAL} = a + b(\text{NE}) \tag{2}$$

where a is the intercept and b is the slope. Due to errors in variables and arbitrary assumptions of ordinary least-squares, orthogonal least-squares is employed to provide estimates of a and b. For the two exchange rates to be interchangeable, the orthogonal least-squares slope coefficient cannot be statistically different from unity. An asymptotic test of the null hypothesis b=1 has been developed by Jackson and Dunlevy (1981). This test is distributive as a chi-square with one degree of freedom. The results of the orthogonal regressions are shown in Table 7. Only two of the nine regional exchange rate indexes (WNC and MATL) are interchangeable with the national index at the .05 level of significance. The implication of this analysis is that the regional exchange rates and the national exchange rate are not interchangeable and their use would generate different regression results in otherwise identical estimations. Specifically, the coefficient estimates for the impact of a change in the exchange rate on some variable of interest (region exports, region employment) would differ depending on the measure of the exchange rate used in the analysis.

4. SUMMARY AND CONCLUSIONS

This paper estimates real exchange rates pertaining to U.S. Bureau of the Census regions. Results indicate that there are nontrivial differences between them and an economywide measure of the real exchange rate. Visually there is some commonality between movements of the total index for the U.S. and movements in the regional indexes. However, the absolute magnitude of the peaks and troughs of the indexes, and the timing of the changes, are different.

Correlations between the total index and the various regional indexes differ considerably. This is reinforced by the fact that the TOTAL index is cointegrated with only two regional indexes (MATL and WSC). Further, it appears the overall exchange rate index for the U.S. is causing, in a Granger sense, only one regional index (WSC). It also appears that only one of the regional indexes (NE) is causing the overall exchange rate. Regional exchange rates do vary from the national exchange rate. In addition, our tests have shown that seven of the regional indexes constructed with 1994 trade weights differ from an identically constructed U.S. index. To the extent that the trade weights may vary over time and to the extent that this variation is likely to be different across regions, the true regional indexes would be more different from each other than our tests indicate.

There are some tentative conclusions to be drawn. First, the results above constitute additional evidence of the utility of regional science in general. The commonly identified U.S. regions have a different pattern of trade with respect to both commodities exported and the composition of countries with which they engage in trade. Second, the study of relationships between international trade of a region and regional economic development issues is still quite new. Researchers investigating how changes in the exchange rate affect regional exports should be cautious in making inferences based upon a national exchange rate index.

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