

Common Trends and Cycles and the Structure of Florida's Economy

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FLORIDA, LIKE THE REST OF THE NATION, HAS UNDERGONE MANY ECONOMIC CHANGES IN THE LAST QUARTER-CENTURY. SOME OBVIOUS EXAMPLES OF THIS ONGOING EVOLUTION ARE THE DECLINE OF THE MANUFACTURING BASE AND THE GROWTH OF INTERNATIONAL TRADE. IN THE CASE OF FLORIDA SPECIFICALLY, THE GROWTH OF THE IMPORTANCE OF TOURISM HAS ALSO FIGURED SIGNIFICANTLY. IN ADDITION TO CHANGES AT THE STATE LEVEL, FLORIDA'S CITIES HAVE BECOME LESS SIMILAR OVER TIME. AS MIGHT BE EXPECTED, THESE GRADUAL ECONOMIC CHANGES COULD AT SOME POINT CAUSE THE STATE'S METRO ECONOMIES TO INTERACT IN NEW WAYS. FOR EXAMPLE, LABOR MARKETS THAT MAY HAVE BEEN VERY SIMILAR IN STRUCTURE AND BEHAVIOR IN ONE PERIOD MAY HAVE BECOME MORE HETEROGENEOUS IN A LATER PERIOD.

Such changes in the structure of a regional economy have implications for economic forecasters, policy-makers, businesses, and the general public. The ultimate effects of economic shocks on a region depend on the ways different parts of that region are linked to each other and to external areas, as well as the region's relative degree of homogeneity. A particular economic policy or shock may have a completely different effect on a highly homogeneous region than it would on a more heterogeneous one.

This article uses multiple cointegration and common cycles analysis to study the evolution of the relationships among some major Florida cities' labor

markets. (See the glossary on page 66 for short discussions of the technical terms.) Cointegration analysis is used to examine the degree and type of long-run relationships that exist in these labor markets. This analysis is extended with the introduction of the common cycle methodology (of Vahid and Engle 1993) to illustrate the short-run dynamics of the labor markets studied.

Cointegration

Cointegration analysis deals with long-run equilibrium relationships among economic variables. When a group of variables move together in a common way over time they may be cointegrated—that

is, influenced by a common (random) trend. This comovement can be caused by economic links that tie the variables together in a long-term bond. Economic theory is used to suggest variables to test for cointegration. Examples may include strongly linked variables such as consumption and income or the levels of total payroll employment among metropolitan statistical areas in a homogeneous, well-integrated state economy. Once economic theory suggests a list of variables that may be cointegrated, statistical tests such as the Engle-Granger (1987) test and the Johansen (1995) test can be used to determine formally if a group of variables is cointegrated. This article suggests that the labor markets within six Florida metropolitan statistical areas (MSAs) may share a cointegrating relationship.

Cointegration analysis can also reveal the response of particular labor markets to shocks in other labor markets. For example, changes in labor demand and supply in one MSA can be transmitted to another. Such information, by helping determine which MSAs are more independent of one another (weakly exogenous) and which react strongly to disturbances in surrounding markets (endogenous), can be valuable for clarifying how the effects of state level policy changes as well as economic shocks are transmitted among individual MSAs.

The Florida MSAs studied are the six largest: Fort Lauderdale, Jacksonville, Miami, Orlando, Tampa, and West Palm Beach. The study of their labor markets began with collecting the seasonally adjusted monthly levels of total nonagricultural payroll employment from January 1970 to June 1996. The data were tested over the entire time period for a cointegrating (or long-run equilibrium) relationship among the MSAs. The hypothesis of a cointegrating relationship over this time period is not rejected.

Even when they are governed by the same basic factors, however, economic relationships change over time. For this reason, the stability of the relationships over the entire sample period was examined using a rolling regression. The results are presented in the first panel of Chart 1. The number 1 on the vertical axis represents the 5 percent level of significance. At points above this line the hypothesis that the equilibrium relationship of the entire time period studied is the same as the subperiods (or the cointegrating vectors of the full sample are the same as those of the subsample) is rejected.

The first panel of Chart 1 shows that the full sample can be divided into three subperiods. The first, 1970 to 1980:06, is a period of rejection of the hypothesis that the full-sample cointegrating vectors are those of the subsample. Next appears a subsample that suggests increasing acceptance of the stability of the coefficients of the cointegrating vectors over the period from

1980:07 to 1987:12. Finally, there is a period of high acceptance of the null hypothesis, from 1988:1 to 1996:06. The stability tests suggest that the relationships among the labor markets of the MSAs change over time.

Next, tests are applied to these subperiods. First, the sample of the period from 1970:01 to 1980:06 is studied to determine which MSAs are included in the long-run equilibrium and which are weakly exogenous. Then an observation is dropped and the cointegrating relationship is examined again. This process was continued for a three-year period.

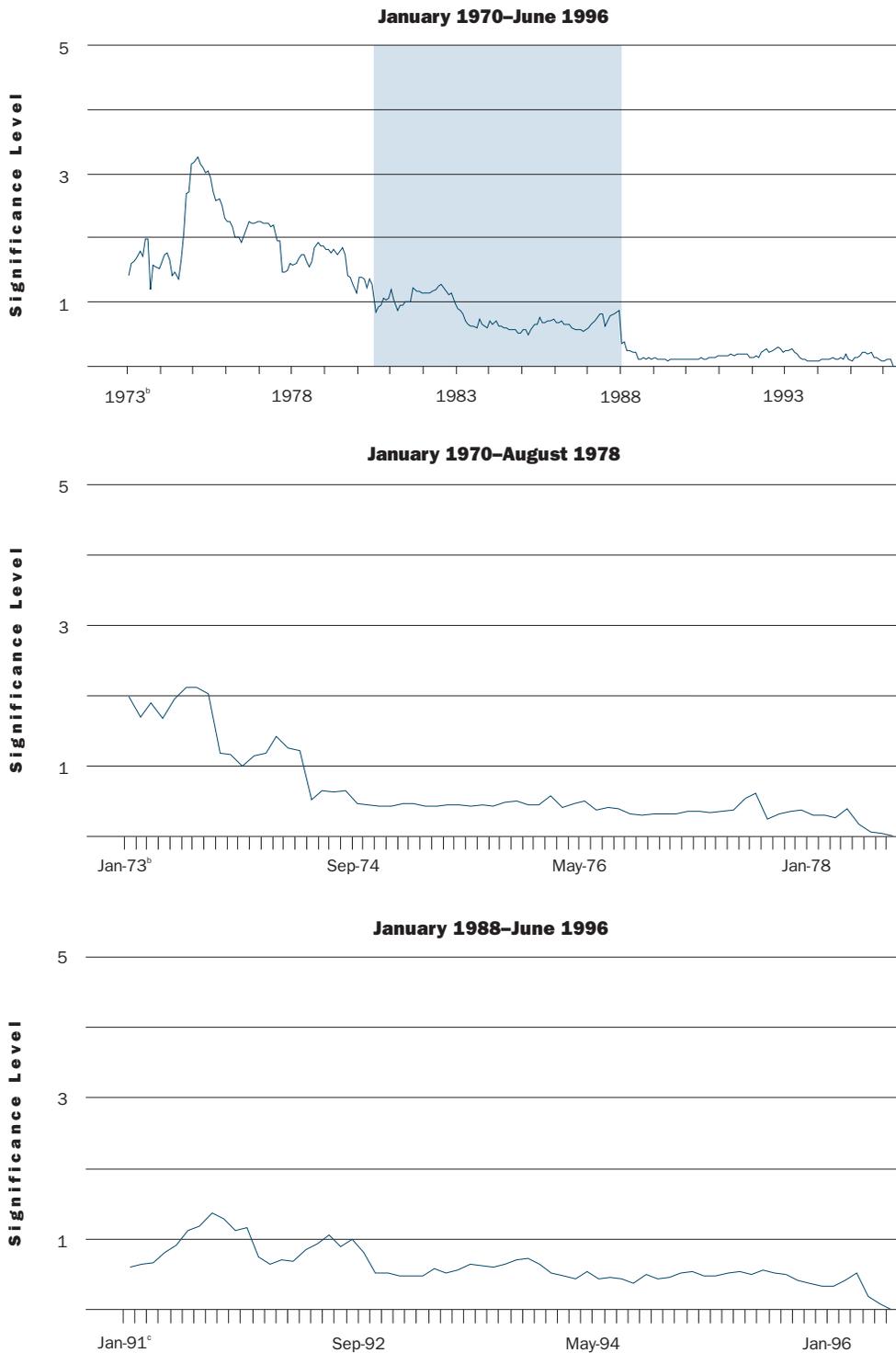
It was found that a stable period in the cointegrating relationships from 1970:01 to 1978:08 (with all cities included in the cointegrating relationship test and with Miami, Tampa, and West Palm Beach found to be weakly exogenous) was interrupted by a period of transition beginning around 1978:09.

The data show that the point of division indicated by the stability test is a time period of relatively dramatic change that begins one to two years before the actual dividing date of 1980:06. An appropriate end date to use in sampling the first period should therefore be shortly before this transition period. August 1978 was chosen because it is the month just before changes in weak exogeneity among the MSAs occur. The same rolling regression technique used in the original sample was used to test this subperiod. The second panel of Chart 1 shows that the hypothesis that the cointegrating relationship for the period from January 1970 to August 1978 is the same over subperiods of this sample is accepted over most of the time period. The results of tests of long-run exclusion and weak exogeneity for this subperiod are shown in Table 1; all MSAs are included in the long-run equilibrium relation, as the hypothesis of exclusion is rejected. The table also shows that Miami, Tampa, and West Palm Beach are weakly exogenous.

Next, moving past the unstable 1980:06–1987:12 transition period indicated in the first panel of Chart 1, the months spanning the last time period are examined. As indicated in the chart, this is the region of high acceptance of the original cointegrating relationship. The dividing date appears to be early 1988, and thus the sample period is from January 1988 to June 1996. As before, tests of the robustness of the cointegrating relationships

Florida's cities have become less similar over time. As might be expected, these gradual economic changes could at some point cause the state's metro economies to interact in new ways.

CHART 1
Tests of the Long-Run Relationships
Among Labor Markets in Six Florida MSAs^a



Note: On the y axis, “1” indicates a 5 percent significance level. Data are seasonally adjusted (by the Federal Reserve Bank of Atlanta) monthly levels of total nonagricultural payroll employment.

^a Miami, Orlando, West Palm Beach, Fort Lauderdale, Tampa, and Jacksonville

^b First observation is the result of the initial sample period, January 1970–January 1973.

^c First observation is the result of the initial sample period, January 1988–January 1991.

Source: Bureau of Labor Statistics

TABLE 1
Chi-Square Tests, Labor Market Data for Six Florida MSAs,
January 1970–August 1978

Critical Value	Miami	Orlando	West Palm Beach	Fort Lauderdale	Tampa	Jacksonville
Long-Run Exclusion						
5.99	9.16	14.39	17.74	12.21	19.53	20.95
Weak Exogeneity						
5.99	0.70	17.54	1.32	9.30	1.48	8.09

TABLE 2
Chi-Square Test, Labor Market Data for Six Florida MSAs,
January 1988–June 1996

Critical Value	Miami	Orlando	West Palm Beach	Fort Lauderdale	Tampa	Jacksonville
Long-Run Exclusion						
9.49	8.48	8.59	17.72	10.45	22.78	14.10

are performed by sampling around the transition point. The results of this period are much less robust than in the first era, perhaps because of increased linkages of all Florida MSAs to regions outside the state and less homogeneity (more specialization) among the MSAs. Miami is always excluded from the cointegrating relationship. Orlando is excluded in most of the time periods around the transition. These findings support the thesis that Florida's economy has become less integrated, apparently beginning around 1988.

There is strong evidence that Miami and Orlando are excluded from the long-run equilibrium relationship, as shown in Table 2. There is also strong evidence that these two MSAs and Fort Lauderdale are weakly exogenous. This condition indicates that these three MSAs not only do not move with the others over the 1988:01–1996:06 period but they are also insulated from short-run shocks in the rest of the state. Just as before, the stability of the cointegrating relationship is tested over this period using the rolling regression and chi-square tests. The third panel of Chart 1 shows that the observed long-run relationship is stable over most of the last sample period.

The above analysis suggests that for some reason the relationship between the MSAs changed over the

sample period. Initially the levels of total payroll employment in the cities grew together in a cointegrated relationship. The nature of this relationship then changed, and the MSAs became less bound by the long-run equilibrium relationship. What could have caused this apparent change in behavior?

The concepts of temporary cointegration and sudden change as introduced by Siklos and Granger (1996) and Krugman (1991, 26), respectively, may help shed light on the observed relationships. Siklos and Granger use the concept of temporary cointegration to describe data for which the underlying series need not be cointegrated at all times. The relationship shown over one time span may be different from that of another period. This change in the long-run equilibrium relationship might be expected if there are changes in the makeup of particular MSAs over time, leading to possible differences in the demand for and supply of labor in each MSA.

The concept of sudden change offers another possible explanation for why the relationships between the MSAs became less cointegrated. Krugman (1991, 26) describes sudden change as the result of a gradual and unnoticed change in the underlying conditions that leads to an explosive apparent change. A likely explanation is that the gradual transitions of Florida MSAs,

Miami and Orlando in particular, as they became increasingly linked to economic regions outside Florida and internally more heterogeneous, fragmented the state's economic integration. The growth of tourism in Orlando and foreign trade in Miami have driven the significant changes in these labor markets.

In testing for the gradual changes in the MSAs that may have created the new relationships, location quotients are useful. Location quotients indicate the relative concentration of a particular industry in a region. In this study location quotients are constructed using total payroll earnings. They are computed by dividing the percentage of total payroll earnings generated by a particular industry in an MSA by the percentage of the industry's total payroll earnings at the state level. A location quotient equal to 1 indicates that total payroll earnings in this industry are as concentrated in the studied MSA as they are in the state as a whole. If greater than 1 the location quotient shows greater concentration in the MSA than at the state level, and if less than 1, less relative concentration. The location quotients are consistent with the hypothesis that increased specialization in tourism in Orlando and trade in Miami have led to the breakup of the cointegrating relationship that held the MSAs together. The location quotients identify some gradual changes in the underlying economic structure that may have resulted in sudden change. Growth in import and export activity through the port of Miami are taken to reflect growth in international trade links. For the Orlando area (Orange County) the hotel and service sector is a proxy for tourism-related activities.

The water transportation location quotient for the Miami area (Dade County) from 1969 to 1994 depicted in Chart 2, shows the rise from an above-average concentration of water transportation in 1969 to the extremely high level of about three times that of the state at the end of the period. The increasing concentration of water transportation in Miami's economy clearly shows Miami's emerging trade links with the rest of the world gradually growing and helping pull Miami out of its cointegrating relationship with the rest of the state. Miami is now the seventh-busiest container port in the United States as well as the number-one cruise port in the world.

The location quotients of Orlando's service sector, measured by sector payroll earnings, tell a similar story about tourism-related growth in that area in Chart 3. In 1969 Orlando was similar to the state in concentration of its service sector. This situation changes over the sample period as this concentration gradually grows to nearly twice the level in the state. Nationally, Orlando is second only to Las Vegas when ranked by the relative percentage of service-sector employment in its economy.

Location quotients of hotel total payroll earnings were calculated to further examine the emergence of tourism-related activities in the Orlando area. Although these data are incomplete (the data for hotel payroll earnings exist only from 1985 to 1987 and 1993 to 1994), in Chart 4 it can be seen that the Orlando area already had a high concentration of hotel payroll earnings in 1985 relative to the rest of the state. This concentration continued to grow to more than five times the state's level by 1994. It seems reasonable to assume that the

CHART 2
Dade County Water Transportation Location Quotient, 1969-94



Source: Bureau of Economic Analysis, provided by Regional Financial Associates

concentration of hotel earnings in Orlando was much lower in 1970.

These dramatic rises in service and hotel-related total payroll earnings indicate the growing importance of tourism in the Orlando area, linking its economy to areas outside of Florida as well as differentiating it from the rest of the state. This emerging link helped remove Orlando from the cointegrating relationship of the early time period.

The changing level of stability in cointegrating relationships reveals periods of economic structural change in the labor forces of the Florida MSAs studied. What began as a high degree of cointegration began to lessen by the last period as Orlando and Miami became excluded. As Siklos and Granger state, "It seems realistic to assume that some series are cointegrated only during some periods and not at others. The reason is that events or important changes in some of the

CHART 3
Orange County Service-Sector Location Quotient, 1969-94

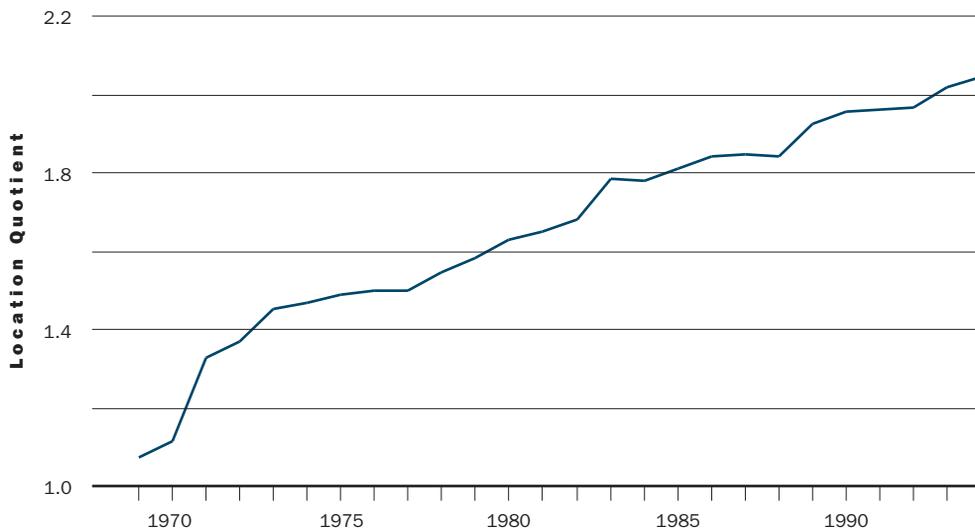
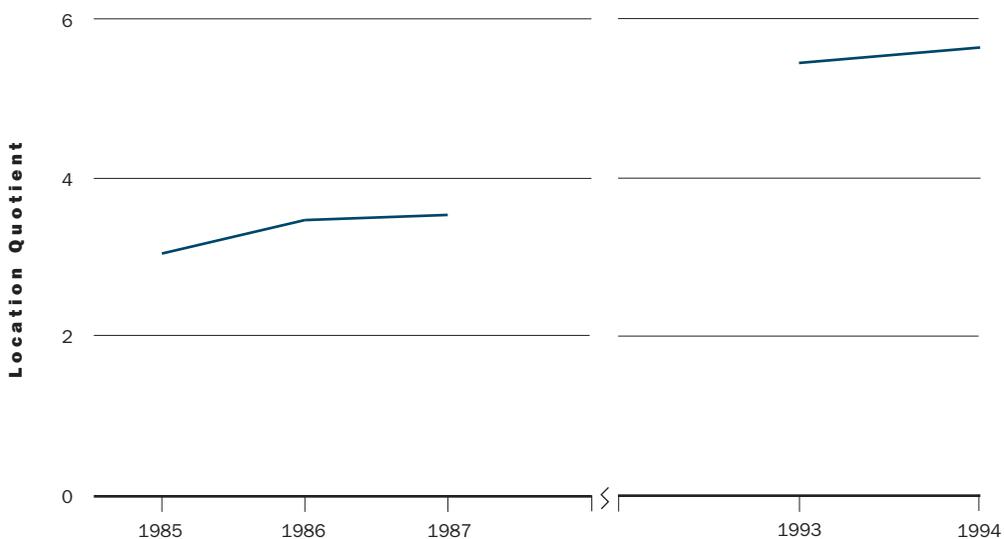


CHART 4
Orange County Hotel Payroll Earnings Location Quotient, 1985-94



Note: Data are unavailable for 1988-92.

Source for Charts 3 and 4: Bureau of Economic Analysis, provided by Regional Financial Associates

Glossary

Cointegration between economic variables may exist if these variables tend to move together in a common way over time. Economic theory may suggest which variables to test for cointegration—for example, strongly linked variables such as consumption and income or the levels of total payroll employment among MSAs in a homogenous, well-integrated state economy.

Common cycles refers to the short-run dynamics of the time series. In this article the decomposition of the levels of total nonagricultural payroll employment reveals the effects of short-run shocks to the group of MSAs.

Common trends refers to the long-run behavior of the levels of total nonagricultural employment in the MSAs. This long-run behavior is revealed by the Vahid-Engle decomposition, which removes the short-run effects of shocks and leaves the long-run trends associated with the time series.

Endogenous metropolitan statistical areas, in the context of this article, are the cities whose labor markets are dependent on and react to demand and supply shocks from other metropolitan areas.

Location quotients are used to determine the relative concentration of a particular industry in a region. If the location quotient is equal to 1 then the particular industry is as

concentrated in the MSA as in the state as a whole. The relative concentration of the industry in the MSA is greater than that of the state if the location quotient is greater than 1 and the reverse if less than 1.

Rolling regressions, in this article, make use of a statistical test (chi-square) to determine whether the cointegrating relationship of the full sample is the same as that of subsamples of the full time period. Starting with a subsample that begins at the start of the original sample, the Chisquare test is performed over and over again adding one more month of data after each test until all the data are included and tested.

Sudden change is introduced by Krugman as the result of “a gradual change in the underlying (economic) conditions (that) can at times lead to explosive . . . change” (1991, 26).

Temporary cointegration is described by Siklos and Granger (1996) as a change in the long-run relationships between variables that could lead to the underlying series not being cointegrated at all times.

Weakly exogenous metropolitan statistical areas transmit internal supply and demand shocks to other less independent metropolitan areas.

institutional features of an economy can interrupt an underlying equilibrium-type relationship possibly for an extended period of time” (1996, 8). Examining cointegrating relationships over different periods of time helps illuminate the evolution of those relationships.

Common Cycles

The remaining discussion explores the short-run dynamics of the Florida MSAs’ labor markets. This analysis will reveal some of the similarities and differences in the reactions of the MSAs to short-run economic shocks. The short-run behavior of the MSAs can be strikingly different. One MSA may be able to expand employment above its long-run trend while another may be left below its long-run trend.

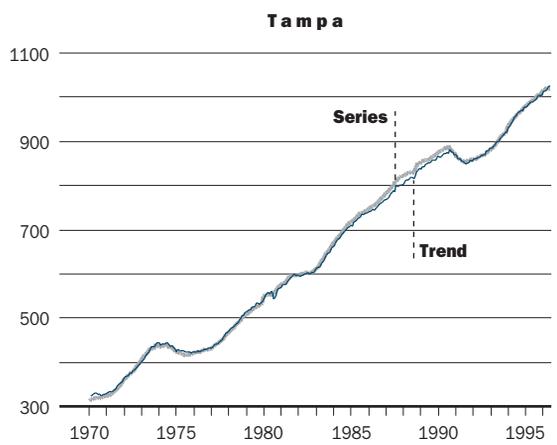
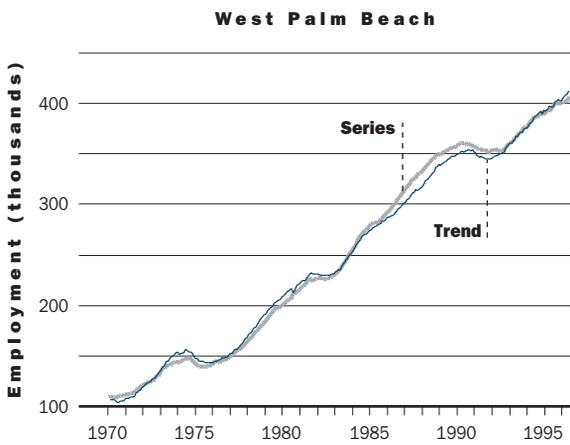
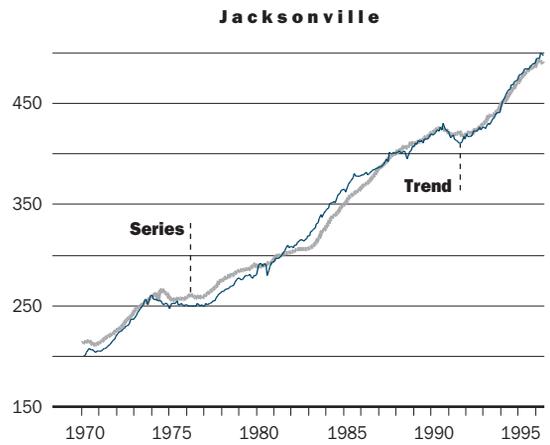
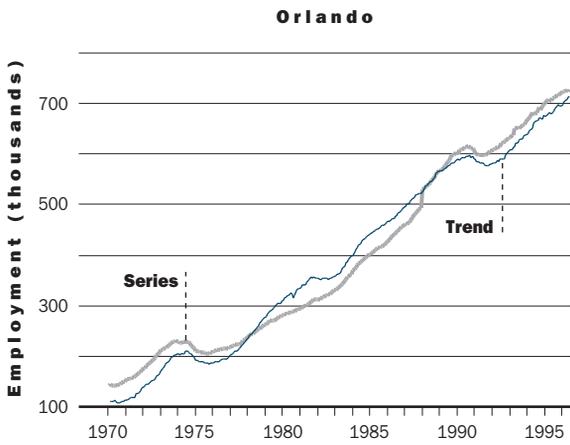
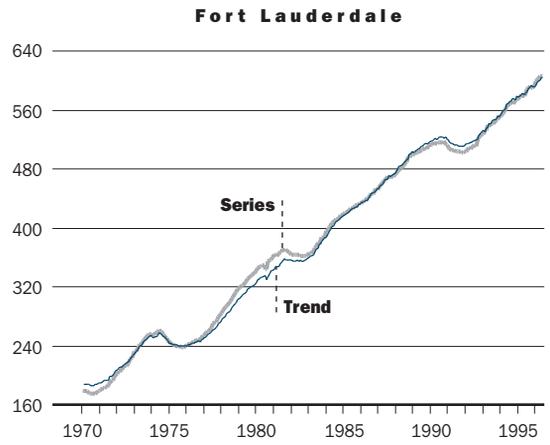
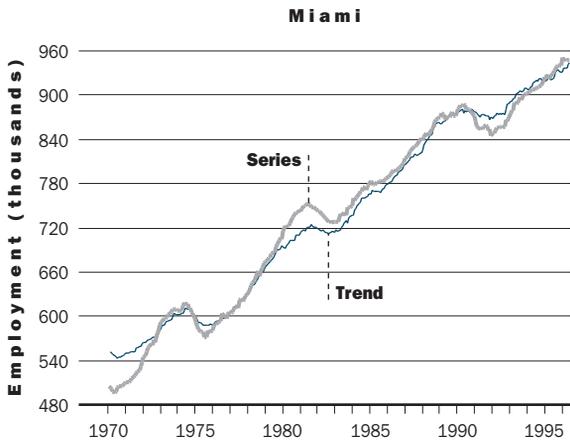
The concepts of common trends and common cycles, as introduced in Vahid and Engle (1993), extend the previous cointegration analysis. Their technique can in some cases be used to separate the long- and

short-run behavior of an economic series. If one can demonstrate that a specific set of mathematical conditions is met, then it is possible to decompose data series such as employment in Florida MSAs into their trend (long-run) and cyclical (short-run) components.

As the appendix shows, the prerequisites of the Vahid-Engle decomposition are met in data for the Florida MSAs, so the series can be decomposed into their long-term and short-term components. Chart 5 depicts the actual series and estimated employment trends (which incorporate other macroeconomic effects and are therefore not straight lines) for the six MSAs from 1970 to 1996. In Chart 6 the cyclical components of the trends are plotted by themselves. These lines correspond to the distance between the actual series and the estimated trend in Chart 5.

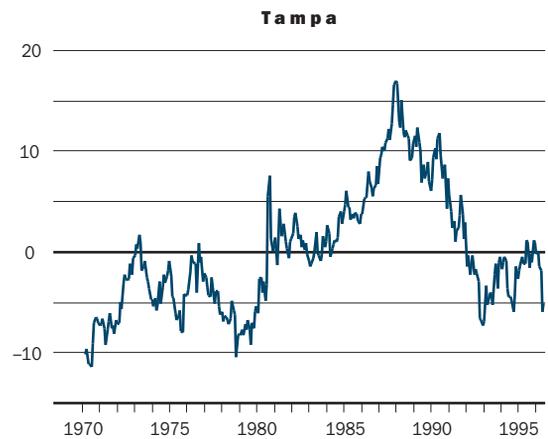
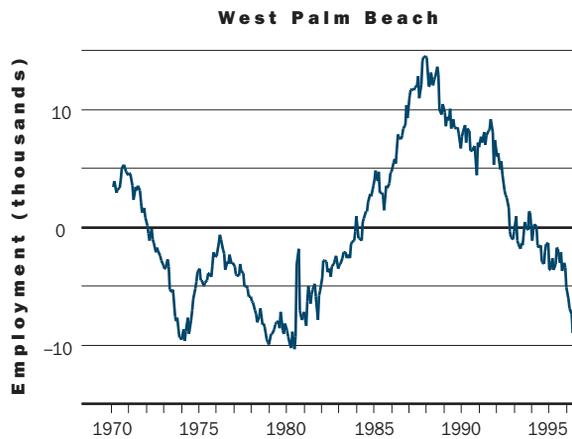
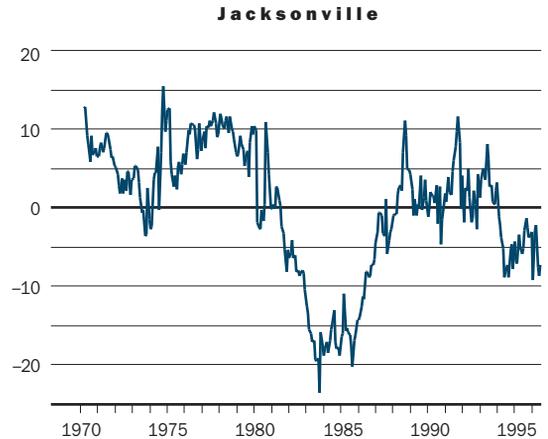
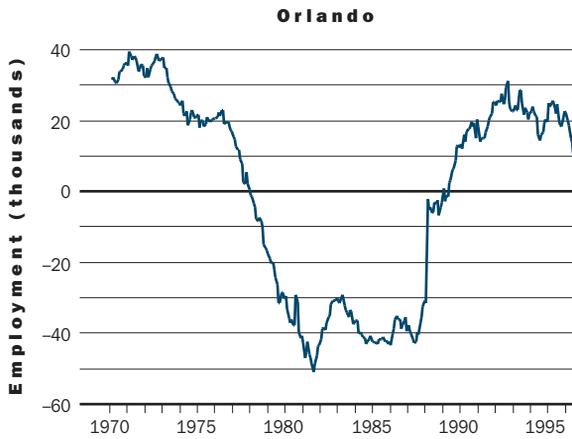
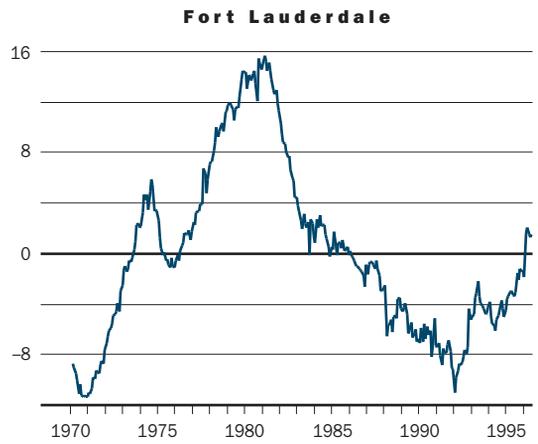
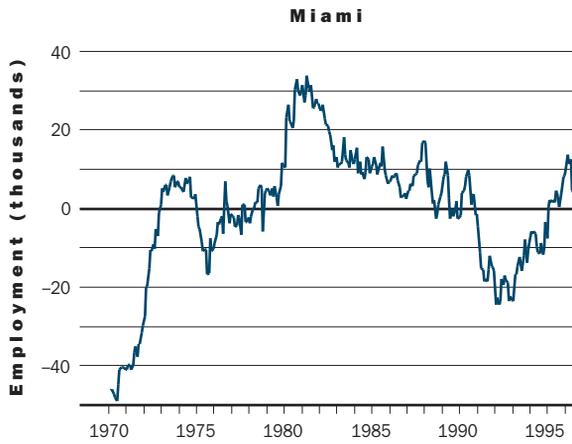
These charts show that for each MSA there are several periods when the actual series is either above or below the estimated trend. These deviations from the

CHART 5
Actual Series and Estimated Trends of Total Nonagricultural Payroll Employment for Six Florida MSAs, 1970-96



Source: Series from the Bureau of Labor Statistics

CHART 6
Estimated Cycles of Total Nonagricultural
Payroll Employment for Six Florida MSAs, 1970-96



long-term trend are generated by short-run economic shocks to the growth of total payroll employment. Positive shocks such as a temporary increase in demand for a locally produced product (for example, a defense contract for a local firm) would lead local businesses temporarily to hire more workers than they otherwise would have. While they were employing more workers, the charts of the actual series and trend would show the actual number of employees exceeding the long-term trend. On the cyclical graphs this gap would correspond to an upswing above the horizontal axis. Shocks in one area may also spill over into others through demand for or supply of labor. Further, two or more areas may be subject to the same outside shocks or to shocks propagating across areas.

Comparing cycles shown by this series of charts reveals both common and differential effects of short-term shocks on the MSA's employment. For example, Miami's and Orlando's deviations from their long-run trends appear in the Charts 5 and 6. Over the sample period the short-run behavior of these two MSAs is very different. In fact, they appear to be on opposite paths, with Miami hitting the height of its cycle in 1980 at a time when Orlando is near its lowest point.

Looking at all of the MSAs, it can be seen that during most of the expansion of the 1980s, Miami, Fort Lauderdale, Tampa, and West Palm Beach are all above their long-run trend. However, Jacksonville's level of total payroll employment, similar to Orlando's, is below its trend. Viewing Miami and Orlando as the driving forces behind Florida's economy could help explain the apparent division of the state into a countercyclical northern half and a procyclical southern one in terms of total payroll employment during this time period.

Further examination of Chart 6 reveals that the MSAs can be grouped into three pairs of similar dynam-

ics—Miami and Fort Lauderdale, Orlando and Jacksonville, and West Palm Beach and Tampa. Miami and Fort Lauderdale are the first to rise above their long-run trends in the 1980s' expansion. They are followed by West Palm Beach and Tampa. Orlando and Jacksonville remained below their long-run trend during most of this period. It is interesting to note that West Palm Beach, although geographically closer to Miami, displays short-run dynamics more similar to Tampa's in terms of the timing of its cyclical upswing.

Conclusion

Cointegration techniques developed by Johansen (1995) and the common trends and common cycles analysis developed by Vahid and Engle (1993) have aided in studying the long- and short-run interrelationships in the behavior of total payroll employment in six Florida MSAs over the past quarter-century. The analysis showed that these MSAs have shared a long-run comovement in their labor markets. However, there are indications that these relationships have changed as the economic structures of the MSAs have evolved. Further, the cyclical dynamics displayed by these cities suggest that the labor markets of the northern half of the state behave differently from those in the southern half in response to short-run economic shocks.

This analysis helps underline the growing diversity of influences on the growth trends of Florida MSAs. It also suggests that these MSAs react differently to short-run shocks. Both of these dynamics are important in gauging the differing effects of policy or economic shocks on the state in parts and as a whole.

Decomposing the Series into Trend and Cyclical Components

Given r cointegrating vectors defined as the $n \times r$ matrix $[\alpha]$ and s cofeature vectors defined as the $n \times s$ matrix $[\beta]$, stack the vectors in one matrix \mathbf{A} :

$$\mathbf{A} = \begin{bmatrix} \beta \\ \alpha \end{bmatrix}$$

Calculate \mathbf{A} -inverse = $[\alpha^- \beta^-]$. Partition \mathbf{A} -inverse into the $s \times n$ matrix $[\beta^-]$ and $r \times n$ matrix $[\alpha^-]$. This calculation allows the decomposition into permanent (P) and cyclical (C) components such that $Y(t) = P + C$. It follows, then, that $P = \beta^- \beta Y(t)$ eliminates the cycles and leaves the trend or permanent component; $C = \alpha^- \alpha Y(t)$ eliminates the trend and leaves the cyclical or temporary component.

Using the maximum eigenvalue test results presented in Table A, it was found that the time series has four cointegrating vectors. Next, to find the number of cofeature vectors, a test of canonical correlations between the series and certain other variables as explained in Vahid and Engle (1993) was used. This test (see Table B) shows that Florida's MSAs share two cofeature vectors, satisfying

the condition of the Vahid-Engle decomposition that the sum of the two groups of vectors add up to the number of variables in the system.

Table A
Test of the Number of Cointegrating Vectors

Test Statistic	r	Test Statistic
Critical Value		
50.30	0	24.63
31.77	1	20.90
27.45	2	17.15
15.65	3	13.39
6.79	4	10.60
0.13	5	2.71

The test of the null hypothesis that the number of the cointegrating vectors is equal to r results in four cointegrating vectors.

Table B
Test of the Number of Cofeature Vectors

Row	Approx F	Numerator DF	Denominator DF	Pr > F
1	2.7092	168	1644.062	0.0001
2	1.9561	135	1381.116	0.0001
3	1.7113	104	1113.348	0.0001
4	1.4652	75	840.884	0.0080
5	1.2902	48	564	0.0968
6	1.0946	23	283	0.3502

The F-test of the null hypothesis that the canonical correlations in the current row and all that follow are zero results in two cofeature vectors. The number of cofeature vectors is equal to the statistically zero canonical correlations (see Vahid and Engle 1993 for detailed explanations). The sum of the number of cointegrating vectors and cofeature vectors equals the number of variables in the system, and the Vahid-Engle decomposition can be used.

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