Economics Bulletin

Volume 35, Issue 1

Dollar depreciations and monthly local employment in three Midwestern states: Evidence from time-series and cointegration analysis

Scott W Hegerty
Northeastern Illinois University

Abstract

As local exports grow globally, it is important for policymakers to understand the role that exchange rates play on local employment. Using current data, this study first examines business-cycle concordance and synchronization and finds that there is relatively weak correlation between local employment either with cities' small neighbors or their states' major metropolis. There are, however, stronger connections to the dollar real effective exchange rate. When we apply Dynamic Ordinary Least Squares in a Seemingly Unrelated Regressions framework to a reduced-form model, we find that most cities, including the major metro areas, do indeed see increased employment following a dollar depreciation. Those cities that do not experience these effects have employment mixes that rely less on manufacturing. These include state capitals, medical centers, and university hubs. Only the results for a trio of medium-sized manufacturing cities in Wisconsin are more difficult to explain, suggesting that further research is necessary.

Citation: Scott W Hegerty, (2015) "Dollar depreciations and monthly local employment in three Midwestern states: Evidence from time-series and cointegration analysis", *Economics Bulletin*, Volume 35, Issue 1, pages 291-297
Contact: Scott W Hegerty - S-Hegerty@neiu.edu.
Submitted: July 14, 2014. **Published:** March 11, 2015.

1. Introduction

As local manufacturers continue to seek global markets, even small U.S. cities might find themselves at the mercy of global economic trends. While in the past, some cities far from the coasts might have felt insulated by these events, this is no longer the case. As a result, it is of utmost importance that policymakers at the state and local level be aware of the role of the dollar on local employment, not only for manufacturing industries, but at the aggregate level.

This study performs an up-to-date analysis of these effects, focusing on large and mid-size metropolitan areas in three Midwestern states. Applying bivariate and multivariate time-series analysis of local employment and the dollar effective exchange rate, we arrive at a number of important conclusions regarding not only integration among cities within each state, but also different impacts of dollar movements on metropolitan employment.

Such studies have long been an important part of the economic literature. Goldberg and Tracy (1990) perform a thorough theoretical analysis of these effects, before testing them empirically at the state and industry level on data that end in the mid 1990s. Carlino *et al.* (1994) find that productivity growth plays more of a role on state output growth than do exchange-rate fluctuations. This study approaches a similar question, applying more updated models to more recent data.

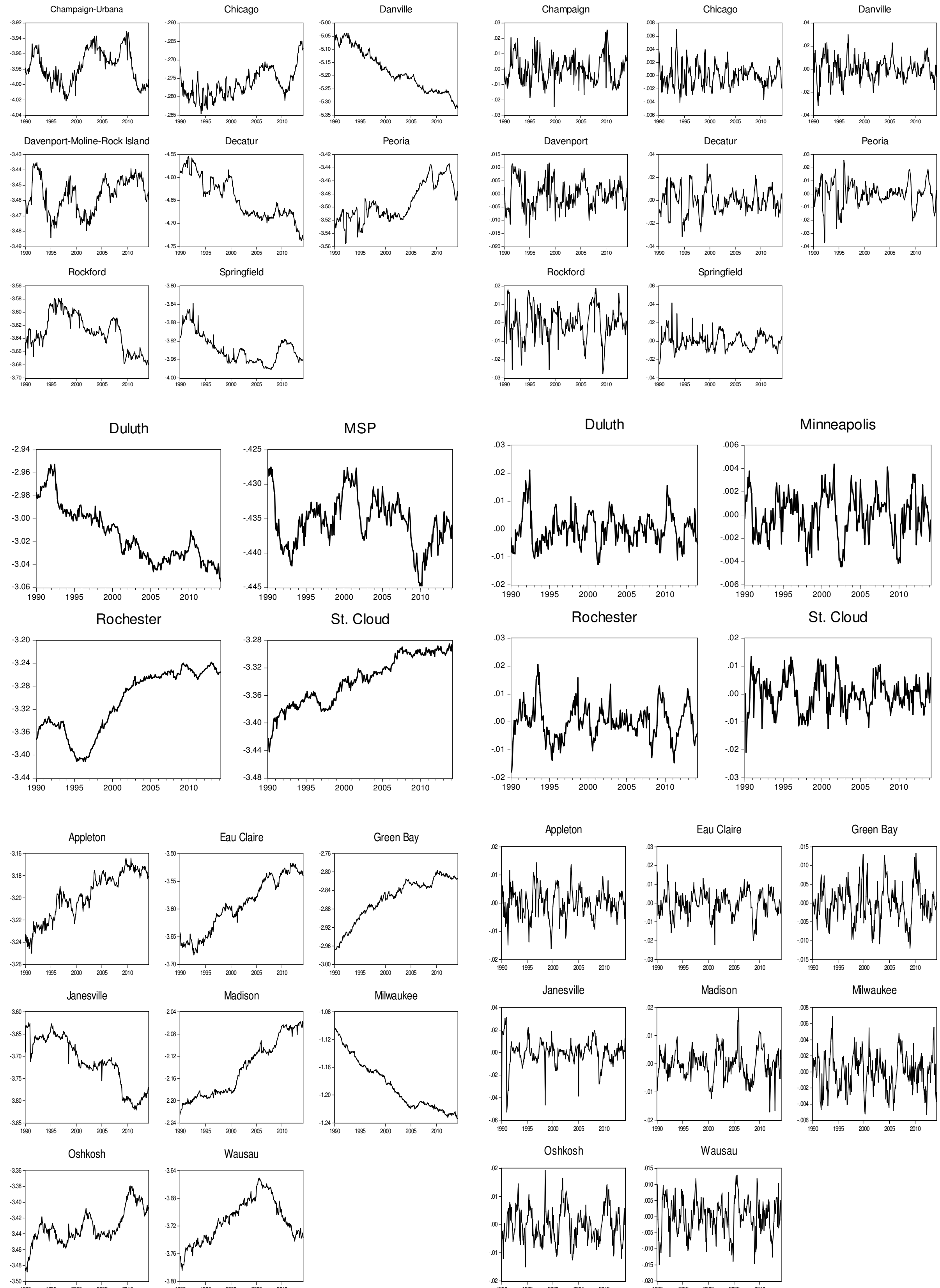
One such method involves examining co-movements and concordances among city employment cycles. Applying a more basic methodology, Hegerty (2010) looks at cross-correlations among certain European business cycles. More formally, Owyang *et al.* (2013) maps whether major U.S. metropolitan areas simultaneously contract. We apply a mixture of these techniques, as well as cointegration analysis, to monthly metropolitan employment data. We find that exchange-rate movements exert a stronger influence than do neighboring cycles, and that while employment is reduced in most cities, areas with dominant government, education, or medical sectors experience employment growth in the wake of an appreciation.

2. Methodology

Using monthly data from the Bureau of Labor Statistics (spanning from January 1990 to March 2014), we conduct a series of bivariate and multivariate analyses. First, we examine each series (in natural logs), as well as cycles created by applying the Hodrick-Prescott Filter (λ = 144,000). These series, which are all scaled by state employment throughout this paper, are depicted in Figure 1. Clearly, employment is decreasing in some cases (such as Danville, IL) and increasing in others (Eau Claire, WI). Major metropolitan areas such as Milwaukee appear to be doing worse than Chicago or Madison. Many cities move with the national business cycle, with the 2008 recession being particularly detrimental, but this is not universally the case.

In particular, Milwaukee's underperformance relative to the state's second-largest city not only has implications for the state's relative economic influence, it also suggests that various metropolitan areas within a state might not move with a common cycle. Government centers appear to be somewhat insulated from national trends—note Springfield, IL's relatively smooth cycle—but Minneapolis-St. Paul is far more diversified. The importance of manufacturing centers, which have the potential to export products, and thus depend on a favorable exchange rate, combined with the fact that regional linkages might also be highly influential, drives this study. In particular, we examine connections among cities and with the dollar effective exchange

Figure 1. (Log) Metropolitan Employment Shares, in Levels (Left) and H-P Filtered Cycles.



rate, in order to determine which effects are stronger. We then ask a metropolitan area's manufacturing share might explain any differences.

We begin by mapping months in which each metropolitan area experiences an increase in cyclical employment alongside periods of dollar depreciation. Following Owyang *et al.* (2013), we calculate the percentage of months in which each city pair within each state is concordant—simultaneously experiencing an employment increase or decrease.

Secondly, we generate cross-correlation functions (CCFs) between each small-city employment cycle and its state's major city (Chicago, Minneapolis-St. Paul, or Milwaukee), and between employment and the real effective exchange rate. CCFs between variables X and Y are calculated as:

$$\rho_{t+k} = \frac{\sum\left(X_t - \bar{X}\right)\left(Y_{t+k} - \bar{Y}\right)}{\sqrt{\sum\left(X_t - \bar{X}\right)^2 \sum\left(Y_{t+k} - \bar{Y}\right)^2}} \quad (1)\,.$$

Each value of *k* represents a lead or a lag—one variable in the present period is correlated with past or future values of the other. This method is used both in studies of business-cycle correlation (where a high value of ρ at $k = 0$ suggests synchronization) and in analyses of the "S-curve" effect in international trade, where a devaluation might be precipitated by a trade deficit and followed by a surplus. (See Bahmani-Oskooee and Hegerty, 2010 for further discussion).

Here, we compare which effect dominates. In the tradition of the international trade literature, we also test a reduced-form empirical model that places each metro's employment (as a share of the state total, to control for common shocks) in a model that includes the nominal effective exchange rate and a set of other important macro variables. Additional controls include U.S. industrial production, "Foreign" IP (proxied by the Advanced Economies index), the oil price (West Texas Intermediate), the ratio of the BLS' Midwestern price index to the U.S. CPI. All variables are in logs, deseasonalized where necessary, and are taken from the International Financial Statistics of the International Monetary Fund.

As an estimation method, the Dynamic Ordinary Least Squares (DOLS) approach of Stock and Watson (1993) is applied. Here, common shocks to the error structure are controlled for by estimating each state's equations simultaneously in a Seemingly Unrelated Regressions (SURE) framework. The basic DOLS specification is:

$$\ln EMP_t = \alpha + \beta_1 \ln Y_t^{US} + \beta_2 \ln Y_t^{AE} + \beta_3 \ln\left(\frac{P_t^{MW}}{P_t^{US}}\right) + \beta_4 \ln P_t^{Oil} + \beta_5 \ln NEER_t + \sum_{i=1}^{5} \gamma_i \Delta Z_{it} + \varepsilon_t \quad (2)$$

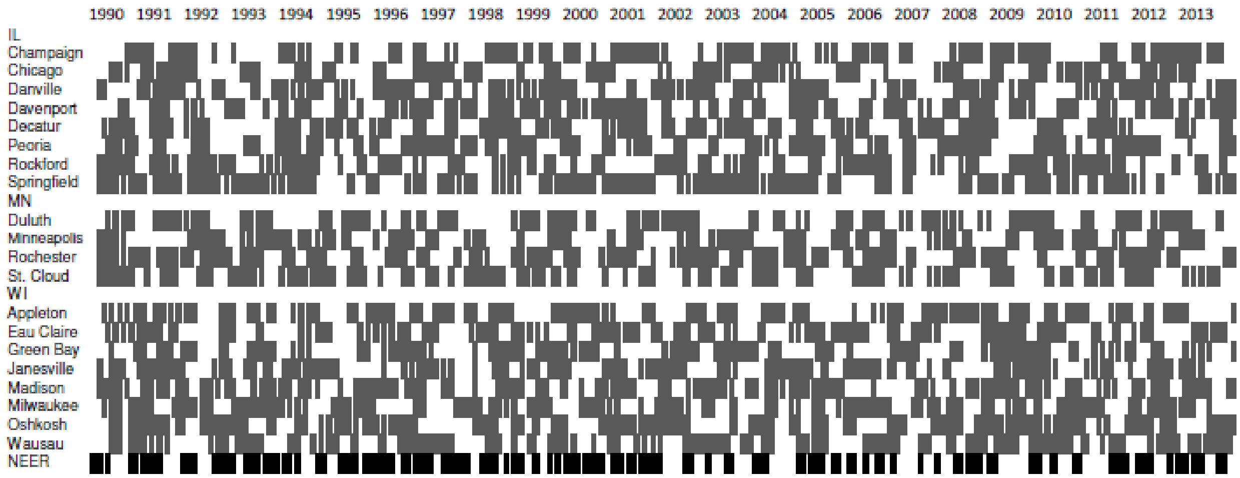
Here, Z represents the differenced right-hand-side variables that are included to ensure stationary residuals.

We then examine whether the fact that some cities' employment expands after a depreciation, while others' contracts, depends on the manufacturing share of each metropolitan area. We find that most cities do indeed see an increase in employment following a depreciation of the dollar, but that certain areas actually experience an increase following an appreciation. Many of these are state capitals or homes to large universities. A brief look at other cities' major employers shows that they, too, might be expected to be more immune from international forces. Only a set of smaller cities in Wisconsin defy explanation. Our results are provided below.

3. Results

Figure 2 depicts a graph of each metropolitan area's growth over our sample period. Employment expansions during a given month are shaded in gray. Constant or declining employment are in white. In addition, depreciations in the nominal effective exchange rate are shown in black. Clearly, there is little evidence of strong cycles or of common patterns among neighboring series. Wisconsin seems to have a period of decline during 1996-1997, and the 2008 financial crisis seems to correspond to overall drops in employment, but other patterns are scant. There is also little evidence of expansions corresponding to or closely following depreciations.

Figure 2. Monthly Employment Expansions (Grey) and NEER Depreciations (Black).



Our test of common cycles also finds few strong patterns. Figure 3 provides the percentage of the total number of months during which each state's city pairs undergo a common phase (both increasing or both unchanging/declining). The percentage, which is roughly one half, is similar among almost all pairs. Some are rather low—such as Danville and Chicago, IL. Also interesting is Madison's relatively low correspondence to Milwaukee and higher correlation with Green Bay, WI. But the overall range between high and low percentages is narrow.

Table 1. City Pairs' Employment Growth Concordance, Percentage of Months.

	Chicago	Danville	Davenport	Decatur	Peoria	Rockford	Springfield
Champaign	51.72%	54.83%	52.76%	55.17%	50.69%	49.66%	53.45%
Chicago		44.48%	54.83%	52.41%	54.14%	49.66%	49.31%
Danville			48.97%	46.55%	51.03%	51.38%	52.41%
Davenport				52.76%	55.86%	45.86%	52.41%
Decatur					54.14%	52.41%	52.76%
Peoria						51.38%	50.34%
Rockford							52.07%

	Minneapolis	Rochester	St. Cloud
Duluth	50.69%	50.34%	51.38%
Minneapolis		50.69%	49.66%
Rochester			51.38%

	Eau Claire	Green Bay	Janesville	Madison	Milwaukee	Oshkosh	Wausau
Appleton	48.97%	53.79%	48.62%	53.45%	46.55%	48.97%	51.72%
Eau Claire		51.03%	54.14%	46.55%	47.24%	51.03%	54.48%
Green Bay			56.90%	55.52%	52.76%	48.97%	54.48%
Janesville				48.97%	51.03%	51.38%	48.62%
Madison					45.52%	55.52%	50.69%
Milwaukee						52.76%	50.00%
Oshkosh							53.10%

Are these cities, then, more closely linked to international economic forces than to state forces? To answer this question, we generate cross-correlation functions (CCFs) between each city's employment cycle and cyclical movements in the U.S. real exchange rate. We also generate CCFs between the cycles of each small city and that of its state's major city. Our results are compared in Figure 4.

Many cities experience a so-called "S-Curve" effect, where lagged correlations are positive and lead correlations are negative. It is interesting to note that this pattern is reversed in a number of cases; we see below that long-run employment also increases after a dollar depreciation for some cities. More important is the apparent lack of large contemporaneous correlations among the large metros and their neighbors. The largest coefficient—between Rochester and Minneapolis/St. Paul, Minnesota—is negative. At the other extreme, the contemporaneous correlation between Madison and Milwaukee is nearly zero, while both are positively correlated with the REER. In no case is there a positive contemporaneous correlation between two cities that is larger in absolute value than the small city's correlation with the real exchange rate. Only at large lags are local effects stronger: Janesville, WI seems to be correlated, but out of sync, with Milwaukee.

Table 2. Cross-Correlation Functions, With 6-Month Leads and Lags.

	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Wisconsin													
Appleton/REER	0.08	0.08	0.10	0.11	0.11	0.10	0.07	0.04	0.01	-0.01	-0.01	-0.02	-0.05
Appleton/MKE	0.02	0.03	0.02	-0.01	-0.03	-0.07	-0.13	-0.17	-0.17	-0.15	-0.15	-0.13	-0.14
Eau Claire/REER	-0.26	-0.26	-0.25	-0.21	-0.13	-0.08	-0.06	-0.02	0.01	0.07	0.13	0.21	0.28
Eau Claire/MKE	0.03	0.04	0.08	0.10	0.06	0.09	0.08	0.10	0.13	0.12	0.12	0.12	0.09
Green Bay/REER	-0.29	-0.29	-0.29	-0.28	-0.26	-0.25	-0.19	-0.12	-0.08	-0.04	0.02	0.06	0.09
Green Bay/MKE	-0.23	-0.26	-0.23	-0.23	-0.16	-0.12	-0.08	-0.10	-0.10	-0.13	-0.13	-0.11	-0.06
Janesville/REER	-0.11	-0.19	-0.23	-0.28	-0.31	-0.29	-0.23	-0.16	-0.09	-0.03	0.01	0.05	0.08
Janesville/MKE	0.25	0.26	0.22	0.16	0.10	0.06	-0.02	-0.03	-0.01	-0.01	-0.01	0.01	0.01
Madison/REER	0.11	0.15	0.20	0.22	0.24	0.27	0.29	0.29	0.30	0.31	0.32	0.33	0.31
Madison/MKE	-0.05	-0.05	-0.03	0.01	0.01	0.00	0.00	0.03	0.06	0.08	0.06	-0.01	-0.06
Milwaukee/REER	0.10	0.13	0.12	0.10	0.08	0.08	0.09	0.12	0.14	0.15	0.16	0.18	0.19
Oshkosh/REER	-0.02	0.02	0.04	0.07	0.11	0.13	0.13	0.12	0.12	0.15	0.20	0.24	0.24
Oshkosh/MKE	0.19	0.13	0.04	-0.03	-0.06	-0.08	-0.05	-0.10	-0.08	-0.04	-0.04	-0.03	0.00
Wausau/REER	0.09	0.10	0.11	0.10	0.05	0.00	-0.05	-0.10	-0.14	-0.11	-0.02	0.05	0.11
Wausau/MKE	0.09	0.03	0.03	0.01	-0.03	-0.06	-0.06	-0.05	0.00	-0.04	0.00	0.02	0.03
Minnesota													
Duluth/REER	-0.19	-0.20	-0.22	-0.21	-0.19	-0.19	-0.18	-0.15	-0.12	-0.08	-0.05	-0.03	0.00
Duluth/MSP	0.01	-0.02	-0.08	-0.12	-0.13	-0.15	-0.14	-0.17	-0.18	-0.24	-0.29	-0.31	-0.30
MSP/REER	-0.05	-0.11	-0.15	-0.22	-0.26	-0.27	-0.31	-0.32	-0.30	-0.29	-0.29	-0.27	-0.25
Rochester/REER	0.14	0.17	0.22	0.27	0.30	0.31	0.34	0.35	0.33	0.32	0.29	0.25	0.23
Rochester/MSP	-0.28	-0.30	-0.29	-0.31	-0.33	-0.33	-0.35	-0.34	-0.31	-0.30	-0.28	-0.24	-0.20
St. Cloud/REER	-0.20	-0.23	-0.27	-0.29	-0.29	-0.30	-0.29	-0.24	-0.19	-0.14	-0.08	-0.03	-0.02
St. Cloud/MSP	0.02	0.00	-0.04	-0.04	0.01	0.08	0.11	0.16	0.21	0.23	0.24	0.25	0.23
Illinois													
Champaign/REER	-0.04	0.01	0.07	0.13	0.13	0.11	0.08	0.06	0.06	0.06	0.06	0.05	0.05
Champaign/CHI	-0.13	-0.12	-0.08	-0.03	-0.07	-0.10	-0.11	-0.09	-0.07	-0.07	-0.07	-0.01	0.00
Danville/REER	-0.06	-0.04	-0.03	0.00	0.01	0.02	0.04	0.05	0.04	0.01	-0.02	-0.07	-0.09
Danville/CHI	0.03	-0.01	-0.04	-0.10	-0.19	-0.20	-0.27	-0.19	-0.16	-0.13	-0.10	-0.05	0.00
Davenport/REER	0.12	0.10	0.06	0.05	0.02	0.00	-0.01	-0.01	-0.03	-0.06	-0.10	-0.14	-0.18
Davenport/CHI	0.14	0.16	0.12	0.10	0.06	-0.03	-0.07	-0.09	-0.12	-0.11	-0.09	-0.05	0.01
Decatur/REER	0.01	-0.02	-0.04	-0.04	-0.04	-0.03	-0.03	-0.05	-0.07	-0.13	-0.19	-0.23	-0.30
Decatur/CHI	-0.10	-0.13	-0.10	-0.08	-0.08	-0.14	-0.14	-0.12	-0.10	-0.06	0.00	0.06	0.14
Peoria/REER	0.26	0.28	0.28	0.28	0.26	0.23	0.19	0.13	0.06	-0.03	-0.13	-0.23	-0.33
Peoria/CHI	-0.06	-0.10	-0.11	-0.07	-0.04	-0.07	-0.04	0.04	0.07	0.08	0.12	0.16	0.18
Rockford/REER	-0.20	-0.25	-0.29	-0.34	-0.38	-0.39	-0.37	-0.37	-0.39	-0.39	-0.35	-0.28	-0.20
Rockford/CHI	0.11	0.12	0.10	0.04	-0.05	-0.08	-0.09	-0.06	0.00	-0.03	-0.05	-0.11	-0.11
Springfield/REER	0.13	0.15	0.15	0.15	0.11	0.09	0.10	0.13	0.16	0.18	0.18	0.20	0.17
Springfield/CHI	-0.21	-0.26	-0.31	-0.31	-0.29	-0.22	-0.20	-0.13	-0.20	-0.13	-0.08	-0.06	-0.06
Chicago/REER	0.22	0.18	0.13	0.05	0.02	0.01	-0.03	-0.07	-0.08	-0.06	-0.02	0.01	0.00

Note: Gray cells equal significant correlations.

Since international influences appear to be stronger than local ones ones, we test the role of the nominal effective exchange rate using DOLS on our log monthly data. Our results from Equation (2) are provided in Table 3. U.S. income is generally significant (although the sign is negative for cities such as Milwaukee). Likewise, Advanced Economy income is significantly positive in the vast majority of cases, indicating that foreign markets do indeed help drive local employment growth. And most relative price coefficients are significantly negative—particularly in Wisconsin—suggesting that rising local prices hurt national competitiveness.

Table 3. Regression Results, DOLS/SURE Model.

Illinois	INPT	LYUS	LYAE	LRP	LPOIL	LNEER	R^2	P-P
Champaign	-3.566 (0.000)	-0.561 (0.000)	0.434 (0.000)	-1.838 (0.000)	0.024 (0.000)	0.310 (0.000)	0.62	-5.98 (0.00)
Chicago	-0.285 (0.000)	0.021 (0.000)	0.004 (0.538)	-0.037 (0.309)	-0.001 (0.380)	-0.016 (0.000)	0.56	-5.09 (0.00)
Danville	-5.381 (0.000)	-0.312 (0.000)	0.175 (0.000)	2.024 (0.000)	-0.041 (0.000)	-0.116 (0.000)	0.96	-4.55 (0.00)
Davenport	-2.949 (0.000)	-0.019 (0.313)	0.070 (0.001)	-0.696 (0.000)	-0.008 (0.010)	-0.042 (0.000)	0.39	-3.76 (0.00)
Decatur	-4.716 (0.000)	-0.163 (0.000)	0.129 (0.002)	0.996 (0.000)	-0.028 (0.000)	-0.089 (0.000)	0.84	-3.87 (0.00)
Peoria	-2.434 (0.000)	0.140 (0.000)	-0.081 (0.009)	-1.409 (0.000)	0.004 (0.399)	-0.062 (0.001)	0.79	-4.38 (0.00)
Rockford	-4.895 (0.000)	0.242 (0.000)	-0.058 (0.140)	1.676 (0.000)	-0.038 (0.000)	-0.144 (0.000)	0.61	-3.75 (0.00)
Springfield	-2.920 (0.000)	-0.302 (0.000)	0.045 (0.121)	-0.262 (0.136)	0.023 (0.000)	0.055 (0.001)	0.85	-6.43 (0.00)
Minnesota	INPT	LYUS	LYAE	LRP	LPOIL	LNEER	R^2	P-P
Duluth	-2.999 (0.000)	-0.138 (0.000)	0.107 (0.000)	0.481 (0.000)	-0.010 (0.000)	-0.042 (0.000)	0.90	-4.67 (0.00)
Minneapolis	-0.798 (0.000)	0.014 (0.008)	0.021 (0.000)	0.389 (0.000)	-0.001 (0.088)	-0.018 (0.000)	0.56	-5.54 (0.00)
Rochester	-2.774 (0.000)	-0.480 (0.000)	0.551 (0.000)	-3.272 (0.000)	0.040 (0.000)	0.307 (0.000)	0.89	-3.73 (0.00)
St. Cloud	-2.587 (0.000)	0.080 (0.000)	-0.052 (0.021)	-1.750 (0.000)	0.017 (0.000)	0.078 (0.000)	0.93	-5.23 (0.00)
Wisconsin	INPT	LYUS	LYAE	LRP	LPOIL	LNEER	R^2	P-P
Appleton	-2.964 (0.000)	0.101 (0.000)	-0.122 (0.000)	-0.574 (0.000)	0.016 (0.000)	0.050 (0.000)	0.88	-4.93 (0.00)
Eau Claire	-3.198 (0.000)	0.197 (0.000)	0.005 (0.848)	-1.748 (0.000)	0.007 (0.070)	-0.007 (0.657)	0.95	-5.09 (0.00)
Green Bay	-2.922 (0.000)	0.234 (0.000)	-0.219 (0.000)	-0.944 (0.000)	0.027 (0.000)	0.129 (0.000)	0.94	-3.99 (0.00)
Janesville	-4.863 (0.000)	0.143 (0.006)	0.067 (0.248)	2.371 (0.000)	-0.073 (0.000)	-0.278 (0.000)	0.80	-3.43 (0.01)
Madison	-0.776 (0.000)	0.056 (0.026)	-0.156 (0.000)	-2.349 (0.000)	0.050 (0.000)	0.141 (0.000)	0.95	-4.56 (0.00)
Milwaukee	-1.304 (0.000)	-0.134 (0.000)	0.125 (0.000)	0.978 (0.000)	-0.025 (0.000)	-0.104 (0.000)	0.97	-3.93 (0.00)
Oshkosh	-2.504 (0.000)	0.000 (0.997)	-0.186 (0.000)	-1.044 (0.000)	0.030 (0.000)	0.126 (0.000)	0.59	-3.65 (0.01)
Wausau	-4.350 (0.000)	-0.160 (0.000)	0.345 (0.000)	-1.174 (0.000)	-0.011 (0.050)	0.153 (0.000)	0.74	-2.60 (0.10)

Note: P-values in parentheses. P-P = Phillips-Perron stationarity test on regression residuals.

The coefficients on the NEER are the key focus of this estimation. Only one case—Eau Claire, WI, which showed strong employment growth throughout the sample period—was unaffected by dollar movements. Significantly negative signs indicate that dollar appreciations do indeed hurt local employment; these are found for six of the eight cities in Illinois, two of four in Minnesota, and three of eight cities in Wisconsin. The remaining cities have significantly positive coefficients, indicating that appreciations help increase local employment.

A look at these cities suggests two possible explanations. First, city size might matter. Chicago, Minneapolis/St. Paul, and Milwaukee all have the expected negative coefficient; the positively-affected ones are all smaller. More importantly, cities' economic functions might help insulate them from international fluctuations. Cities that are less manufacturing-dependent might benefit from a stronger dollar, which results in cheaper inputs, while enjoying a funding base that is less dependent on a fluctuating currency.

In Illinois, Champaign (education) and Springfield (government) are the two cities with positive coefficients; the same is true of Rochester, Minnesota, with its large medical sector. St. Cloud is also home to a large university and has a hospital as its largest employer. Likewise, Wisconsin's capital (and education center) also fits into this category. The only cities that defy easy explanations are three medium-sized cities in Wisconsin: Appleton, Green Bay, and Wausau. All are relatively industrial (with large paper industries) but appear not to be as heavily influenced by the exchange rate as are other manufacturing cities such as Janesville. This study, therefore, opens the door to further research on the specific characteristics that drive such results.

4. Conclusion

Because foreign markets make up a growing share of many U.S. exports, more small cities can expect to be influenced by international macroeconomic forces. As a result, policymakers should be cognizant of the role that foreign economies, and particularly the exchange rate, plays on local employment. This study performs such an analysis, using the most recent data to perform a battery of time-series tests.

An examination of business-cycle concordance and synchronization shows that there is relatively weak correlation between local employment within a state and that of its small neighbors or major metropolis. Cross-correlations show the dollar real effective exchange rate to be more influential. When we apply Dynamic Ordinary Least Squares to a reduced-form model that includes U.S. and foreign income, relative prices, the oil price, and the nominal effective exchange rates, we arrive at further interesting results.

First, most cities do indeed see lower employment following a dollar appreciation. The three largest cities, as expected, see this reduction. But this confirms that smaller-city policymakers should be wary of the role that exchange rates play on their citizens, even though they might seem to be in somewhat isolated regions of the country. Secondly, those cities that do not experience these declines have employment mixes that might rely less on manufacturing. Eau Claire, WI—the only area with no significant effect—has a large university and a history of producing lumber (which is difficult to ship internationally in an unprocessed form). The other cities, such as Wisconsin's and Illinois' state capitals and locations of the main state universities, also are positively affected by dollar appreciations. Only the results for a trio of medium-sized manufacturing cities in Wisconsin are more difficult to explain, suggesting that further research is necessary.

References:

Carlino, G., B. Cody, and R. Voith (1990) "Regional impacts of exchange rate movements" *Journal of Regional Analysis and Policy* **20**, 89-102.

Goldberg, L. and J. Joseph Tracy (2000) "Exchange rates and local labor markets" in *The Impact of International Trade on Wages* by R. Feenstra, Ed., University of Chicago Press, 269-307.

Bahmani-Oskooee, M. and S.W. Hegerty (2010) "The J- and S-curves: A survey of the recent literature" *Journal of Economic Studies* **37**, 580-596.

Hegerty, S.W. (2010) "Central European business cycles: Might global (and local) linkages dominate regional ones?" *Eastern European Economics* **48**, 56-73.

Owyang, M.T., J. Piger, and H.J. Wall (2013) "Discordant city employment cycles" *Regional Science and Urban Economics* **43**, 367-384.

Stock, J.H. and M. W. Watson (1993) "A Simple estimator of cointegrating vectors in higher order integrated systems" *Econometrica* **61**, 783-820.