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Metropolitan Business Cycle Analysis for Lubbock

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Abstract. This study develops a business cycle index (BCI) for Lubbock Metropolitan Statistical Area (MSA). The Stock & Watson (1989; 1991; 1993) methodology is used to develop the BCI and assumes that the co-movements of key economic indicators have a single underlying, unobservable factor. This factor is extracted from the indicators and used to calculate an index that represents economic conditions through an econometric approach. The model uses the Kalman filter smoothing approach which smooths across variables and over time. This results in an index that is smoother with less pronounced expansions and recessions. Indicator series used for the study are: establishment employment, unemployment, real retail sales and real wages that begin in 1990 and include complete data through the end of 2015. Results indicate that the Lubbock business cycle has peaks and troughs that occur later than those for the national economy.

Keywords. Regional Economics; Business Cycles; Economic Indicators.
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1. Cities and Technology: From Industrial to AI Era

The economic performance of Lubbock is generally difficult to assess. Although some monthly labor market and real estate data exist, there is no overall gauge of current economic activity (LEDA, 2009). One means for doing so is provided by a business cycle index. A business cycle index (BCI) is designed using a set of economic indicators that define the state of an economy over time (Cañas, Coronado, & Lopez, 2005). While BCIs are useful tools, relatively few exist for metropolitan economies in the United States.

The objective of this study is to develop a BCI for Lubbock. To achieve that goal, the Stock & Watson (1998; 1999) methodology is used to create the index. Indicators utilized for this purpose include establishment employment, the unemployment rate, real wages, and real retail sales. The empirical method extracts from each series information relevant to the current state of the Lubbock economy and combines this information into an index that reflect metropolitan business cycle conditions (Cañas, Gilmer, & Phillips, 2003).

Remaining sections of the study are as follows. A brief overview of prior research on regional business cycle indices is provided in the next section. Data and methodology are reviewed next. Empirical results are then discussed. The final section includes a summary and closing statements.

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2. Literature Review

The need to measure overall economic activity, and the lack of consensus on the appropriate method to do so, has led to a great deal of research on BCIs. Beginning in 1930, the National Bureau of Economic Research (NBER) started publishing empirical business cycle studies (Burns & Mitchell, 1946). That approach sought to explain business cycles using two elements. First are co-movements among individual economic variables, which allow the creation of composite leading, coincident, and lagging indexes (Diebold & Rudebusch, 1996). Second is the division of business cycles into separate phases related to expansions and contractions of the economy. Initial NBER efforts included 487 economic variables in an attempt to identify turning points and determine whether variables lead, coincide, or lag changes in overall business conditions (Cañas, Gilmer & Phillips, 2003). Reliable series were eventually grouped into composite indexes of leading, coincident, and lagging economic indicators (Phillips, 1998; 1999). From 1960 through 1995, the U.S. Department of Commerce housed the composite indexes (Phillips, 2005).

Since 1995, the Conference Board (CB) has produced the coincident indexes for the U.S. economy. The index combines the movements of employees on nonagricultural payrolls, personal income less transfer payments, an index of industrial production, and manufacturing and trade sales (CB, 2012). Thecoincident index is calculated by averaging the four economic data series for smoothness, and the volatility of each indicator is then equalized using a predetermined standardized factor, which the CB updates once a year (CB, 2012).

As an alternative approach, Stock & Watson (1989; 1991; 1993) develop a dynamic single-index factor model using a Kalman filter. Stock & Watson (1989) construct the coincident index with the same indicators as the CB model but use a different employment variable (Phillips, 2005). Stock & Watson statistically estimate the weights of the component series that best identifies a single, time-dependent, underlying factor (Stock & Watson, 1989). The process incorporates co-movements in the components and attempts to identify the underlying state of the economy (Cañas, Gilmer & Phillips, 2003). The model uses the Kalman filter smoothing approach which smooths across variables and over time. This results in an index which is smoother because it turns down less often during expansions and increases less often during recessions (Phillips & Cañas, 2004).

Clayton-Matthews & Stock (1998; 1999) apply this methodology to the Massachusetts economy to estimate coincident and leading indexes. The coincident indicators must exhibit comovement with regional economic activity, high frequency, timely availability, historical availability, reliability, low noise, and robustness to revisions. The variables used for the Massachusetts coincident indicator model are measures of employment, the income tax base, the sales tax base, and the unemployment rate (Clayton-Matthews & Stock, 1998; 1999).

Phillips (2005) estimates a Texas coincident index using that methodology, also.

Variables used include nonfarm employment, quarterly Texas Real Gross State Product (RGSP), and the Texas unemployment rate. One-step ahead forecast errors, described in Clayton-Mathews & Stock (1998; 1999), are tested to determine whether the white noise components of the error terms are uncorrelated with past values of itself, the forecast errors of other indicators, and past changes in the indicators. Furthermore, the Neftci (1982) test confirms that the new Texas coincident index has fewer false signals and improved timing for predicting recessions than the Phillips (1988) index. The cyclical behavior of the new index is also found to be correlated with the employment and RGSP indicators.

Cañas, Gilmer, & Phillips (2003) develop a coincident index for the Houston metropolitan economy using the Stock & Watson model. The coincident index developed uses the indicators of established employment, unemployment rate, real wages, and real retail sales. Additionally, the average growth rate of personal income is used to re-trend the series. The coincident index is correlated with historical U.S. economic recessions and expansions. Cañas, Gilmer, & Phillips (2003) use the same methodology and indicators to create a coincident index for the El Paso metropolitan economy. The coincident index for El Paso follow the U.S. industrial production manufacturing index along with Ciudad Juarez maquiladora employment due to the high international involvement with Mexico.

Phillips & Cañas (2008) use the dynamic single-factor approach to measure business cycles in four Texas border economies and Mexico. Seasonally adjusted changes in non-farm employment, the unemployment rate, real wages, and retail sales are used to determine coincident indexes for El Paso, Laredo, Brownsville / Harlingen (Brownsville), and McAllen/Edinburg/Mission (McAllen). Correlation, spectral, and cluster analysis are used to study economic integration between border cities, the US, Texas, and Mexican economies. The correlation and spectral analysis allow to test for breaks in the cyclical relationships between the border economies and broader economies after 1994, the year the North American Free Trade Agreement (NAFTA) was enacted. Results obtained indicate that business cycles in Brownsville, McAllen, and Laredo have become increasingly correlated with the business cycle in Mexico subsequent to 1994. In contrast, the business cycle of El Paso has become comparably more aligned with the business cycles of Texas and the US.

The Stock & Watson methodology has been applied to data for a variety regional economies to create BCIs. The BCIs estimated using this methodology have been shown to provide informative and accurate measures of the overall states of the respective economies analyzed. Accordingly, the Stock & Watson methodology is used to estimate a BCI for the Lubbock metropolitan economy. The four broad regional indicators used to estimate the BCI are establishment employment, the unemployment rate, real wages, and real retail sales.

3. Theoretical Model and Data

Stock & Watson (1989; 1991; 1993) develop and apply the dynamic single factor, multiple indicator model at the national level. This study utilizes this basic model to estimate a BCI for Lubbock. The fundamental structure of the dynamic single factor model is:

$$Y_t = \beta + \gamma(L)\Delta C_t + \mu_t \tag{1}$$

$$D(L)\mu_t = \varepsilon_t \tag{2}$$

$$\phi(L)\Delta C_t = \delta + \eta_t \tag{3}$$

where $Y_t = \Delta X_t$ are the stationary first differences of natural logs of the coincident component series and C_t represents the log of the unobserved state of the economy. L represents the lag operator. The lag polynomials $\phi(L)$ and $D(L)$ are assumed to have finite orders p and k, respectively. The disturbances ε_t and η_t are assumed to be serially uncorrelated and uncorrelated with each other at all leads and lags. The lag polynomial matrix $D(L)$ is assumed diagonal, implying that the μ_t are contemporaneously and serially uncorrelated with each other.

Seasonally adjusted changes in non-farm employment, the unemployment rate, real total wages, and real retail sales are used to define a coincident index for Lubbock. The series are converted to first differences of natural logs (except the unemployment rate which is just differenced) and normalized by subtracting the respective mean differences and dividing by the respective standard deviation of those differences. This results in $\beta = 0$ in Equation (1) and $\delta = 0$ in Equation (3). The scale of the $\gamma(L)$ coefficients is fixed by setting the variance of η to one and the timing of the coincident index is fixed by setting $\gamma_1(L) = 0$ for employment in Equation (1). An assumption for all other indicators is that $\gamma_i(L) = 0$ for all lags greater than 2. This allows the component to have up to a two-month, or two-quarter, lag with the business cycle index.

Equation (3) defines the dynamics of the underlying state of the economy, while Equation (1) shows how each of the component series is associated to this underlying growth process. ΔC_t is the common comovement in the growth of the indicators, Y. The idiosyncratic components of each of the time series are modeled in Equation (2). The idiosyncratic components, μ, are stationary, mean zero, autoregressive stochastic processes (Clayton-Matthews & Stock, 1998; 1999). Growth in the state of the economy is modeled as a stationary autoregressive process. Phillips & Cañas (2008) indicates that if the component series of Y_t move together with the metropolitan economy, then the common movement C_t can be interpreted as the current state of that economy, also known as the coincident index.

Maximum likelihood estimates of the parameters of Equations (1) - (3) and estimation of the filtered state are attained by representing Equations (1) - (3) in state form and using a Kalman filter (Clayton-Matthews & Stock, 1998; 1999). This formulation has two parts, the state equation and the measurement equation. The state equation describes the evolution of the unobserved state vector, which consists of $\Delta C_t, \mu_t$, and their lags. The measurement equation relates the observed variables to the elements of the state vector (Stock & Watson, 1991).

The state equation is obtained by combining Equations (2) and (3). Because one objective is to estimate the level of C_t using information up to time *t*, it is convenient to augment these equations at this point by the identity $C_{t-1} = \Delta C_{t-1} + C_{t-2}$ (Stock & Watson, 1991). The transition equation for the state is thus given by:

$$\begin{bmatrix} C_{t-1}^* \\ \mu^* \\ C_t \end{bmatrix} = \begin{bmatrix} \phi^* & 0 & 0 \\ 0 & D^* & 0 \\ Z_c & 0 & 1 \end{bmatrix} \begin{bmatrix} C_{t-1}^* \\ \mu_{t-1}^* \\ C_{t-2} \end{bmatrix} + \begin{bmatrix} Z_c' & 0 \\ 0 & Z_\mu' \\ 0 & 0 \end{bmatrix} \begin{bmatrix} \eta_t \\ \varepsilon_t \end{bmatrix} \tag{4}$$

where:

$$C_t^* = [\Delta C_t \ \Delta C_{t-1} \ \dots \ \Delta C_{t-p+1}]'$$
$$\mu_t^* = [\mu_t' \ \mu_{t-1}' \ \dots \ \mu_{t-k+1}']'$$
$$\phi^* = \begin{bmatrix} \phi_1 \dots \phi_{p-1} & \phi_p \\ I_{p-1} & 0_{(p-1)\times 1} \end{bmatrix}$$
$$D^* = \begin{bmatrix} D_1 \dots D_{k-1} & D_k \\ I_{n(k-1)} & 0_{n(k-1)\times n} \end{bmatrix}$$
$$Z_c = [1 \quad 0_{1\times(p-1)}]$$
$$Z_\mu = [I_n \quad 0_{n\times n(k-1)}]$$

and where I_n denotes the $n \times n$ identity matrix, $0_{n\times k}$ denotes and $n \times k$ matrix of zeros, and $D_i = diag(d_{1i}, \dots, d_{ni})$, where $d_j(L) = 1 - \sum_{i=1}^{k} d_{ji} L^i$.

The measurement equation is obtained by writing Equation (1) as a linear combination of the state vector:

$$Y_t = \beta + [\gamma Z_c \quad Z_\mu \quad 0_{n+1}] \begin{bmatrix} C_t^* \\ \mu_t^* \\ C_{t-1} \end{bmatrix} \tag{5}$$

Asterisks are used for notational compactness to indicate that a vector of variables or a matrix of variables is actually being employed. Equations (4) and (5) become less unwieldy by doing so (Stock & Watson, 1989; 1991).

Equations (4) and (5) can be rewritten in the standard form:

$$\alpha_t = \mu_\alpha + T_t \alpha_{t-1} + R\zeta_t \tag{6}$$

$$Y_t = \beta + Z\alpha_t + \xi_t \tag{7}$$

where:

$$\alpha_t = (C_t^{*'} \mu_t^{*'} C_{t-1})'$$
$$\zeta_t = (\eta_t \varepsilon_t)'$$

and where the matrices $T_t, R,$ and Z respectively denote the transition matrix in Equation (5), the selection matrix in Equation (5), and the selection matrix in equation (6), and $\mu_\alpha = (\delta 0_{1x(p+nk)})'$. The covariance matrix of ζ_t is $E\zeta_t\zeta'_t = \sum$. For generality, a measurement error term ξ_t, assumed uncorrelated with ζ_t, has been added to the measurement Equation (8), and the transition matrix T_t is allowed to vary over time.

The Kalman filter is applied to this state representation of the model. Let $\alpha_{t|\tau}$ denote the estimate of α_t based on $(y_1, \ldots, y_\tau)$, let $E[\xi_t \xi_t'] = \mathrm{H}$, $E[\varsigma_t \varsigma_t'] = \sum$, and $P_{t|\tau} = E[(\alpha_{t|\tau} - \alpha_t)(\alpha_{t|\tau} - \alpha_t)']$. Given this notation, the prediction equations for the Kalman filter are:

$$\alpha_{t|t-1} = \mu_\alpha + T_t \alpha_{t-1|t-1} \tag{8}$$
$$P_{t|t-1} = T_t P_{t-1|t-1} T_t' + R\Sigma R' \tag{9}$$

The forecast of Y_t at time t-1 is $Y_{t|t-1} = \beta + Z\alpha_{t|t-1}$ and updating equations for the filter are:

$$\alpha_{t|t} = \alpha_{t|t-1} + P_{t|t-1} Z' F_t^{-1} v_t \tag{10}$$
$$P_{t|t} = P_{t|t-1} - P_{t|t-1} Z' F_t^{-1} Z P_{t|t-1} \tag{11}$$

where$F_t = E[v_t v_t] = ZP_{t|t-1}Z' + H$ and $v_t = Y_t - Y_{t|t-1}$.

Clayton-Mathews & Stock (1998; 1999) describes the three outcomes of this procedure: $\Delta C_{t|t-1}$, which are the prediction estimates; $\Delta C_{t|t}$, which are the filtered estimates; and $\Delta C_{t|T}$, which are the smoothed estimates. In the prediction estimates, the state of each period is estimated with information available through the prior period. The predication estimates are used to form one-step ahead prediction errors, $\hat{\varepsilon}_{t|t-1} = \Delta x_t - \Delta x_{t|t-1}$, which are used to calculate the likelihood based on the initial parameter estimates. These predication errors are the fitted residuals from Equations (1) and (2), where the estimates for $\Delta C_{t|t-1}$ are used in place of the unobserved ΔC.

The filtered estimates use information available through the current period. The smoothed estimates use the entire set of information in the sample to estimate the state in each period (Clayton-Matthews & Stock, 1998; 1999). The two estimates are commonly referred to as "Kalman filter" and "Kalman smoother," respectively. The analysis uses the Kalman smoother with weights that rapidly approach zero as they move away from the current period. As the data approach the end of the sample, the estimates go to $\Delta C_{t|t}$ (Clayton-Matthews & Stock, 1998; 1999).

From Equation (3), the Kalman filter models each of the component series as left-hand side variables with the (unobserved) coincident index on the right hand side. From the given structure, quarterly variables are modeled as functions of current and past values of the monthly underlying series. This allows quarterly data to enter the equations with monthly data as follows:

$$\Delta X_t = \gamma(L)\Omega(\mathrm{L})\Delta C_t + \mu_t \tag{12}$$

where $\Omega(\mathrm{L}) = 1 + 2L + 3L^2 + 2L^3 + L^4$ and $\Delta X_t = X_t - X_{t-3}$ where t represents months.

The methodology employed produces indexes which are designed to be stationary and have unit variances. In order to make the index reflective of the distinctive movements and the volatility in the region, two adjustments are made. First, the variance of the growth rate of the index is scaled to the average variance of the growth rates in the component series. Second, the average growth rate in the index is set equal to the average growth in real metropolitan personal income over the course of the sample period (Phillips & Cañas, 2008).

The data for this study begin in 1990 because the Bureau of Labor Statistics (BLS) have only reconstructed data series using the 2007 North American Industry Classification System (NAICS) back to 1990. Combining the Standard Industrial Classification (SIC) system data with NAICS data can produce biased estimates (Tebaldi and Kelly, 2012). Non-farm seasonally adjusted payroll employment monthly data series are available from 01:1990 to 07:2016 from the Federal Reserve Bank of Dallas (FRBD). Unadjusted non-farm employment data series are retrieved by FRBD from the Quarterly Census of Employment and Wages (QCEW), published by BLS in collaboration with the Texas Workforce Commission. The QCEW data account for 98 percent of all county, metropolitan, state, and national jobs in the USA. Berger & Phillips (1993; 1994) describe a two-step seasonal adjustment process that estimates and applies two separate seasonal adjustment factors for the two separate parts of the data. Early benchmarking and two-step seasonal adjustments are done by FRBD.

Another monthly indicator is the unemployment rate available from 01:1990 to 07:2016 from FRBD. The unemployment rate data are retrieved from the BLS and seasonally adjusted by the FRBD using the X-12 procedure. Those data are released at the same time as non-farm employment figures each month.

The Lubbock BCI also uses quarterly retail sales which are available from Q1:1990 to Q4:2015 and compiled by the Texas Comptroller of Public Accounts. To avoid bias in the retail sales indicator, data prior to 2002 are converted into NAICS using the 2002 NAICS to 1987 SIC concordance provided by the U.S. Census Bureau (USCB, 2002). The retail sales data series are then seasonally adjusted using the X-12 procedure and adjusted for inflation using Q4:2015 as the base period. Total wage data are available from Q1:1990 to Q4:2015 and obtained from the Texas Workforce Commission. Total wage data are seasonally adjusted with the X-12 procedure and then adjusted for inflation using Q4:2015 as the base period.

4. Empirical Analysis

Dynamic Single-Factor Model (DSFM) software is used to estimate the BCI for the Lubbock MSA economy. The structure of the model, estimation, and transformation from the estimated state to the economic index are developed using Stock & Watson methodology (Clayton-Matthews, 2005). Four seasonally adjusted indicators are used to create the coincident index for Lubbock: establishment employment, the unemployment rate, real retail sales, and real total wages. Table 1 lists the variables and their descriptions.

Table 2 provides summary statistics for each indicator. The employment indicator for Lubbock MSA over the course of the sample period reaches a maximum of about 142 thousand and follows a gently upward-sloping trend. The unemployment indicator exhibits a more cyclical movement with a minimum of 2.7 percent and a maximum of 6.7 percent throughout the sample period. The retail sales indicator experiences a slight dip in 2002 due to the conversion of SIC to NAICS codes for the time series data from 1990 to 2001. Real retail sales have a skewness of 0.401566 and kurtosis of 2.405778. Real total wages increase steadily over the course of the sample period and display a skewness of 0.02629 and a kurtosis of 2.163425.

Table 1. *Variables, Definitions, and Units of Measure*

Variable	Description
Employment, EMP	Lubbock MSA Monthly Total Nonfarm Payroll Employment, early benchmarked using preliminary releases of the QCEW from the TWC, and two-step seasonally adjusted in thousands; Bureau of Labor Statistics, Federal Reserve Bank of Dallas
Unemployment, UR	Lubbock MSA Monthly Total Labor Force currently unemployed and seeking employment, two-step seasonally adjusted in percent; Bureau of Labor Statistics, Federal Reserve Bank of Dallas
Real Retail Sales, RRS	Lubbock MSA Quarterly Retail Sales defined by NAICS, seasonally adjusted in quarter four 2015 dollars; Texas Comptroller of Public Accounts
Real Total Wages, WSD	Lubbock MSA Quarterly Total Wages for all industries, seasonally adjusted in quarter four 2015 dollars*; Texas Workforce Commission

Notes: * Wages represent total compensation paid during the calendar quarter, regardless of when services were performed. Included in wages are wages, salaries, pay for vacation and other paid leave, bonuses, stock options, tips, the cash value of meals and lodging.

Table 2. *Summary Statistics*

Variable	Mean	Median	Max.	Min.	Std Dev	Skewns	Kurtosis
EMP	120.559th	122.752th	142.017th	97.243th	12.087	-0.3749	2.2480
UR	4.45%	4.3%	6.7%	2.7%	0.8964	0.5282	2.4058
RRS	$1.394bln	$1.343bln	$1.867bln	$1.087bln	$199.8th	0.4016	2.0076
WSD	$1.082bln	$1.089bln	$1.427bln	$0.827bln	$15.4th	0.0263	2.1634

Sample period: Employment and Unemployment 01:1990 – 07:2016. Real Retail Sales and Real Total Wages Q1:1990 – Q4:2015.

The coefficient estimates for the BCI model are reported in Table 3. In the table, the b prefix represents the γ parameters from Equation (1). The t-statistics for employment, unemployment rate, real retail sales, and real wages are strongly significant and the coefficients exhibit the expected signs.

The coinindxar estimates in Table 3, refer to the autoregressive coefficients ($\phi(L)$) of ΔC_t as described in Equation (3). Autoregressive coefficients of the coincident index itself are included in order to further reduce month to month noisiness. Fifth-order autoregression coefficients are included into the coincident index and are statistically significant. One measure of smoothness is the sum of the autoregressive coefficients of the coincident index. The closer the sum of the autoregressive coefficients is to one, while remaining less than one, the smoother the BCI (Phillips, 2005). The autoregressive coefficients of the BCI, sum to 0.799593.

In Table 3, the ar prefix refers to the autoregressive parameters from Equation (2) and the s parameters measure the variance of the error terms in Equation (2). The autoregressive parameters are determined by a univariate equation for each transformed series and statistically significant autoregressive terms are included in the estimation of the BCI. The employment, unemployment rate, and retail sales are employed with first-order autoregression. Second-order autoregression coefficients are incorporated into the model for the wage indicator. The autoregressive coefficients for each of the indicators are statistically significant. The specification search that led to the estimated autoregressive structures of the idiosyncratic portions of the indicators in Equation (2) were aided by the white noise specification test.

Table 3. *Coincident Index Estimates*

Variable	Coefficient	Asymptotic Std Error	t-statistic
bEMP	0.292286	0.0822606	3.55316***
bUR	-0.206015	0.0573209	-3.59407***
bRRS	0.0156561	0.00814259	1.92275**
bWSD	0.0153468	0.0063326	2.42346***
arEMP1	-0.247013	0.0700078	-3.52837***
arUR1	-0.192626	0.062077	-3.10301***
arRRS1	-0.427811	0.0897932	-4.7644***
arWSD1	-0.69825	0.101304	-6.89259***
arWSD2	-0.213545	0.10132	-2.10763**
sEMP	0.840683	0.0528507	15.9067***
sUR	0.926229	0.0428639	21.6086***
sRRS	0.879936	0.0630693	13.9519***
sWSD	0.796476	0.0578123	13.7769***
coinindxar1	0.784951	0.165712	4.73684***
coinindxar2	-0.261086	0.144831	-1.80269**
coinindxar3	0.420578	0.120736	3.48346***
coinindxar4	-0.756333	0.168152	-4.49792***
coinindxar5	0.611483	0.142066	4.30423***

Sample period: Employment and Unemployment 01:1990 – 07:2016. Real Retail Sales and Real Total Wages Q1:1990 – Q4:2015.

Note: *p<0.10; **p<0.05; ***p<0.01.

Table 4 reports the results of the whiteness test performed on the one-step-ahead errors from Equation (2). The test assesses whether the noise components in Equation (2) are predictable. Clayton-Matthews & Stock (1998; 1999) use the test to check the assumption of a single latent factor by verifying that one-step ahead forecast errors $\varepsilon_{t|t-1}$ are uncorrelated with previous values of itself, the forecast errors of the other indicators, and previous changes in the indicators. The test is implemented using a series of regressions. For each regression, the dependent variable is one of the one-step ahead forecast errors of the component series, and the independent variables consist of a constant and six lags each of the forecast errors and the indicators. An F-test is then performed on the joint significance of each regression. The p-values correspond to the F-test of the null hypothesis that the coefficients, other than the constant, are all zero (Clayton-Matthews & Stock, 1998; 1999).

If the single index model has the proper specification, the coefficients on the lags should jointly be insignificantly different from zero. Only one out of the thirty-two F-statistics is significant at the 5% level. Generally, the hypothesis that the coefficients on the six lags are jointly indistinguishable from zero cannot be rejected, which supports the assumption of a single common factor.

Table 4. *F-Statistics for 6-lag Specification White Noise Test with One-Step Ahead Forecast Error used as the Dependent Variable*

	Dependent Variables			
	eEMP	eUR	eRRS	eWSD
eEMP	0.534485	2.17698**	1.48439	0.834579
eUR	0.479343	0.499904	0.490425	0.155985
eRRS	1.26506	0.591134	0.513299	0.988615
eWSD	0.426109	0.566386	0.680802	1.56898
EMP	0.49195	1.68487	1.70699	0.821974
UR	0.405473	0.35392	0.457348	0.236261
RRS	0.891985	0.534071	0.259539	1.04359
WSD	0.52431	0.525605	0.90335	0.831168

Sample period: Employment and Unemployment 01:1990 – 07:2016. Real Retail Sales and Real Total Wages Q1:1990 – Q4:2015

Note: *p<0.10; **p<0.05; ***p<0.01. Ho: Coefficients are jointly zero. Failure to reject Ho supports the existence of a single common factor.

The cumulative dynamic multipliers are the average growth rates of each of the indicator series and the weights are the share that each average growth rate contributes to the common co-movement growth rate, ΔC (Murphy, 2005). Table 5 lists the cumulative dynamic multipliers and the component shares. The dynamic cumulative multipliers indicate the response of the estimated state to a unit pulse in each indicator. Each dynamic cumulative multiplier gives the relative importance of each indicator in forming the estimated state. The cumulative weighted multipliers suggest the following weighting scheme for the indicators: employment, 1.45201; unemployment rate, -0.789402; real retail sales, 0.296703; real wages, 0.551994. The employment indicator for Lubbock gets the greatest weight followed by the unemployment rate. Changes in the employment represent 46.99% of the movement in the index, while changes in the unemployment rate get a weight of 25.55%. The larger weight assigned to employment is a helpful result due to the reliability and timeliness of the employment series. It should reduce the impacts of revisions caused by the later incorporation of the quarterly data values for retail sales and wages (Phillips & Cañas, 2008).

Table 5. *Lubbock BCI Cumulative Dynamic Multipliers*

Variable	Multiplier	Share
Employment	1.45201	46.9889
Unemployment Rate	-0.789402	25.5461
Real Retail Sales	0.296703	9.60171
Real Wages	0.551994	17.8633

Sample period: Employment and Unemployment 01:1990 – 07:2016. Real Retail Sales and Real Total Wages Q1:1990 – Q4:2015

Figure 1 plots the computed index of coincident economic activity in the Lubbock MSA. The index maps cyclical swings in the economy, but not long-term trends in economic growth (Cañas, Gilmer, & Phillips, 2003). The BCI produced by the methodology employed is designed to be stationary and have a unit variance. Adjustments are made in order to make the index reflective of the distinctive movements and volatility in the region. The coincident index is re-trended and scaled to historical growth in real personal income published by the Bureau of Economic Analysis (BEA). Personal income offers a broad measure of the local economy, but cannot be used in the coincident index because of annual periodicity. This series is used to set the BCI long-run trend (Phillips & Hamden, 2004). Shading in Figure 1 indicates the beginning and end of recessions for the U.S. based on the dates from the NBER.

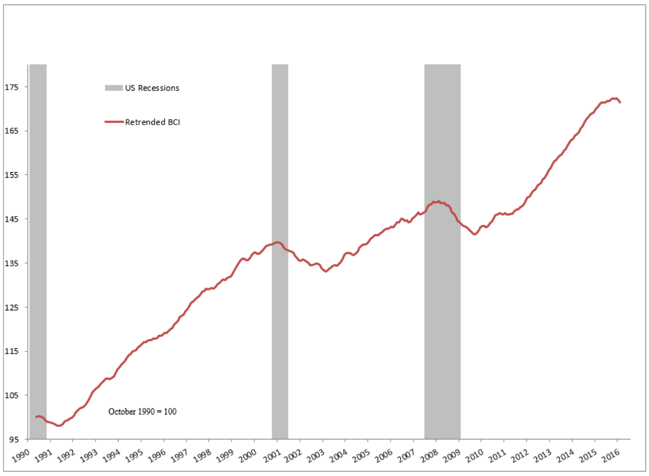

Figure 1. *Lubbock BCI*

As shown in Figure 1, the last three national recessions have been accompanied by regional downturns in Lubbock. That is not surprising, but the BCI indicates that recoveries from all three downturns took longer to materialize in Lubbock than elsewhere. A potential reason behind that is the prevalence of manufacturing in Lubbock and the multiple stresses and structural changes affecting those sectors during the rapid globalization era of the world economy (Cañas, Gilmer, & Phillips, 2003). Several other major developments affected the Lubbock economy during the sample period. Retail trade benefited from exceptional cotton crops in 1993 and 1997 as well as the ongoing consolidation of regional business activity in Lubbock (CLPD & LEC, 2000). Encouragingly, the closures of the Reese Air Force Base in 1997 and a Texas Instruments Plant in 1998 did not translate into economy-wide slumps.

The BCI represents a new tool for understanding the local economic performance in Lubbock. It incorporates movements in four regional indicators: establishment employment, unemployment, real retail sales, and real wages. Given how much Lubbock economic conditions can deviate from national business cycle developments, the BCI provides a potentially helpful tool to business and policy analysts for this region of Texas.

5. Conclusion

This study employs the coincident index estimation procedure proposed by Stock & Watson (1989; 1991; 1993) and software developed by Clayton-Matthews (2005) to create a BCI for Lubbock. A dynamic factor model that aggregates the underlying movements of establishment employment, unemployment rate, retail sales, and wages is estimated to provide a summary measure of current economic activity. The empirical method extracts from each indicator information relevant to the current state of the Lubbock economy and combines this information into an index that reflects metropolitan business cycle conditions.

Each indicator incorporated into the BCI starts from the year 1990, including retail sales, following conversion from SIC to NAICS for the years 1990 to 2001. The parameter estimates are statistically significant for Equations (1) - (3), and form the heart of the model. The sum of the autoregressive coefficients used to calculate the coincident index is 0.799593. The closer the sum of the autoregressive coefficients is to one, while remaining less than one, the smoother the resulting BCI. The Lubbock BCI is fairly smooth. Overall movements in the Lubbock BCI follow the last three national recessions, but recovery phases for this regional economy took longer to materialize.

The Lubbock BCI of coincident activity offers a tool for understanding local economic performance by helping to identify turning points, expansions, and recessions in this region of Texas. Because it employs the same method that is used to analyze other metropolitan economies of Texas, the Lubbock BCI provides information that is comparable to what is utilized for other areas of the state. It will potentially help analysts more reliably gauge economic conditions relative to those prevailing elsewhere in Texas.

Historical Data Appendix

Table A1. *MonthlyHistorical Data*

Date	**Employmt**(1000s)	**Unemp. Rate**(Percent)	**CPI-U: All Items** (Monthly)	**CPI** 2015Q4 = 100	**Nominal Total Personal Income**	**Real TotalPers Income** (Base Period 2015Q4)
Jan-90	97.731	4.7	127.500	53.5495287641469	$3,883,635.00	$7,252,416.76
Feb-90	97.585	4.8	128.000	53.7595269161631	$3,883,635.00	$7,224,087.01
Mar-90	98.544	4.7	128.600	54.0115246985827	$3,883,635.00	$7,190,382.09
Apr-90	98.559	4.8	128.900	54.1375235897924	$3,883,635.00	$7,173,647.30
May-90	99.129	4.9	129.100	54.2215228505989	$3,883,635.00	$7,162,533.98
Jun-90	99.315	5.1	129.900	54.5575198938249	$3,883,635.00	$7,118,422.92
Jul-90	99.164	5.2	130.500	54.8095176762445	$3,883,635.00	$7,085,694.54
Aug-90	98.774	5.3	131.600	55.2715136106802	$3,883,635.00	$7,026,467.61
Sep-90	99.456	5.5	132.500	55.6495102843095	$3,883,635.00	$6,978,740.66
Oct-90	98.941	5.2	133.400	56.0275069579388	$3,883,635.00	$6,931,657.70
Nov-90	98.941	5.1	133.700	56.1535058491485	$3,883,635.00	$6,916,104.24
Dec-90	99.247	5.2	134.200	56.3635040011648	$3,883,635.00	$6,890,336.34
Jan-91	98.882	4.7	134.700	56.5735021531811	$3,965,899.00	$7,010,170.57
Feb-91	98.598	5.0	134.800	56.6155017835843	$3,965,899.00	$7,004,970.15
Mar-91	98.200	5.2	134.800	56.6155017835843	$3,965,899.00	$7,004,970.15
Apr-91	97.734	5.3	135.100	56.7415006747941	$3,965,899.00	$6,989,415.07
May-91	98.127	5.5	135.600	56.9514988268103	$3,965,899.00	$6,963,642.89
Jun-91	97.853	5.4	136.000	57.1194973484233	$3,965,899.00	$6,943,161.59
Jul-91	97.563	5.5	136.200	57.2034966092298	$3,965,899.00	$6,932,966.05
Aug-91	97.499	5.6	136.600	57.3714951308429	$3,965,899.00	$6,912,664.54
Sep-91	97.243	5.6	137.000	57.5394936524559	$3,965,899.00	$6,892,481.58
Oct-91	97.446	5.8	137.200	57.6234929132624	$3,965,899.00	$6,882,434.23
Nov-91	97.728	6.0	137.800	57.8754906956819	$3,965,899.00	$6,852,467.17
Dec-91	98.207	6.4	138.200	58.0434892172949	$3,965,899.00	$6,832,633.69
Jan-92	98.705	5.9	138.300	58.0854888476982	$4,261,426.00	$7,336,472.64
Feb-92	98.878	6.0	138.600	58.2114877389079	$4,261,426.00	$7,320,592.83
Mar-92	98.890	6.0	139.100	58.4214858909242	$4,261,426.00	$7,294,278.70
Apr-92	99.089	5.9	139.400	58.5474847821339	$4,261,426.00	$7,278,580.82
May-92	99.115	5.8	139.700	58.6734836733437	$4,261,426.00	$7,262,950.37
Jun-92	99.566	5.8	140.100	58.8414821949567	$4,261,426.00	$7,242,213.90
Jul-92	100.295	5.6	140.500	59.0094807165697	$4,261,426.00	$7,221,595.49
Aug-92	100.325	5.6	140.800	59.1354796077795	$4,261,426.00	$7,206,208.57
Sep-92	100.778	5.7	141.100	59.2614784989892	$4,261,426.00	$7,190,887.08
Oct-92	100.840	5.6	141.700	59.5134762814087	$4,261,426.00	$7,160,438.72
Nov-92	100.951	5.7	142.100	59.6814748030217	$4,261,426.00	$7,140,282.67
Dec-92	101.687	5.8	142.300	59.7654740638283	$4,261,426.00	$7,130,247.13
Jan-93	100.905	5.3	142.800	59.9754722158445	$4,533,138.00	$7,558,319.81
Feb-93	102.288	5.3	143.100	60.1014711070543	$4,533,138.00	$7,542,474.28
Mar-93	102.595	5.0	143.300	60.1854703678608	$4,533,138.00	$7,531,947.45
Apr-93	102.866	4.9	143.800	60.3954685198770	$4,533,138.00	$7,505,758.48
May-93	103.326	4.8	144.200	60.5634670414900	$4,533,138.00	$7,484,938.07
Jun-93	103.190	4.6	144.300	60.6054666718933	$4,533,138.00	$7,479,751.00
Jul-93	103.387	4.5	144.500	60.6894659326998	$4,533,138.00	$7,469,398.40
Aug-93	103.384	4.5	144.800	60.8154648239096	$4,533,138.00	$7,453,923.13
Sep-93	103.816	4.5	145.000	60.8994640847161	$4,533,138.00	$7,443,641.86
Oct-93	104.120	4.6	145.600	61.1514618671356	$4,533,138.00	$7,412,967.51
Nov-93	104.074	4.4	146.000	61.3194603887486	$4,533,138.00	$7,392,658.01
Dec-93	104.045	4.5	146.300	61.4454592799583	$4,533,138.00	$7,377,498.77
Jan-94	103.331	4.6	146.300	61.4454592799583	$4,777,676.00	$7,775,474.47
Feb-94	104.290	4.8	146.700	61.6134578015714	$4,777,676.00	$7,754,273.45
Mar-94	104.148	4.6	147.100	61.7814563231844	$4,777,676.00	$7,733,187.73
Apr-94	104.839	4.6	147.200	61.8234559535876	$4,777,676.00	$7,727,934.21
May-94	105.127	4.4	147.500	61.9494548447974	$4,777,676.00	$7,712,216.37
Jun-94	105.359	4.4	147.900	62.1174533664104	$4,777,676.00	$7,691,358.45
Jul-94	106.214	4.4	148.400	62.3274515184266	$4,777,676.00	$7,665,444.17
Aug-94	106.516	4.5	149.000	62.5794493008462	$4,777,676.00	$7,634,576.61
Sep-94	106.115	4.1	149.300	62.7054481920559	$4,777,676.00	$7,619,235.87
Oct-94	106.798	4.1	149.400	62.7474478224592	$4,777,676.00	$7,614,135.98
Nov-94	107.208	4.0	149.800	62.9154463440722	$4,777,676.00	$7,593,804.51
Dec-94	107.434	3.8	150.100	63.0414452352819	$4,777,676.00	$7,578,627.02
Jan-95	107.872	4.0	150.500	63.2094437568949	$4,986,532.00	$7,888,903.47
Feb-95	108.124	3.9	150.900	63.3774422785080	$4,986,532.00	$7,867,991.86
Mar-95	108.249	4.5	151.200	63.5034411697177	$4,986,532.00	$7,852,380.77
Apr-95	108.878	4.0	151.800	63.7554389521372	$4,986,532.00	$7,821,343.69
May-95	109.363	3.9	152.100	63.8814378433470	$4,986,532.00	$7,805,916.97
Jun-95	109.046	4.0	152.400	64.0074367345567	$4,986,532.00	$7,790,551.00
Jul-95	109.576	4.0	152.600	64.0914359953632	$4,986,532.00	$7,780,340.58
Aug-95	109.660	4.3	152.900	64.2174348865730	$4,986,532.00	$7,765,075.03
Sep-95	109.992	4.2	153.100	64.3014341473795	$4,986,532.00	$7,754,931.23
Oct-95	110.120	4.2	153.500	64.4694326689925	$4,986,532.00	$7,734,722.94
Nov-95	110.049	4.2	153.700	64.5534319297990	$4,986,532.00	$7,724,658.24
Dec-95	110.162	4.4	153.900	64.6374311906055	$4,986,532.00	$7,714,619.70
Jan-96	110.022	4.5	154.700	64.9734282338315	$5,297,462.00	$8,153,274.57
Feb-96	110.274	4.4	155.000	65.0994271250413	$5,297,462.00	$8,137,494.04
Mar-96	110.610	4.2	155.500	65.3094252770576	$5,297,462.00	$8,111,328.46
Apr-96	110.225	4.3	156.100	65.5614230594771	$5,297,462.00	$8,080,151.03
May-96	110.411	4.3	156.400	65.6874219506868	$5,297,462.00	$8,064,652.02
Jun-96	110.540	4.0	156.700	65.8134208418966	$5,297,462.00	$8,049,212.35
Jul-96	110.246	4.0	157.000	65.9394197331064	$5,297,462.00	$8,033,831.69
Aug-96	110.504	3.8	157.200	66.0234189939129	$5,297,462.00	$8,023,610.53
Sep-96	110.897	3.9	157.700	66.2334171459291	$5,297,462.00	$7,998,171.06
Oct-96	110.898	3.9	158.200	66.4434152979454	$5,297,462.00	$7,972,892.39
Nov-96	111.927	4.0	158.700	66.6534134499616	$5,297,462.00	$7,947,773.00
Dec-96	111.683	4.0	159.100	66.8214119715747	$5,297,462.00	$7,927,791.17
Jan-97	112.185	3.9	159.400	66.9474108627844	$5,511,225.00	$8,232,170.49
Feb-97	112.723	4.0	159.700	67.0734097539942	$5,511,225.00	$8,216,706.17
Mar-97	113.282	4.1	159.800	67.1154093843974	$5,511,225.00	$8,211,564.30
Apr-97	113.272	4.0	159.900	67.1574090148007	$5,511,225.00	$8,206,428.87
May-97	113.244	4.1	159.900	67.1574090148007	$5,511,225.00	$8,206,428.87
Jun-97	114.222	4.1	160.200	67.2834079060104	$5,511,225.00	$8,191,061.02
Jul-97	114.639	4.0	160.400	67.3674071668169	$5,511,225.00	$8,180,847.73
Aug-97	114.582	3.8	160.800	67.5354056884300	$5,511,225.00	$8,160,497.36
Sep-97	114.930	4.0	161.200	67.7034042100430	$5,511,225.00	$8,140,247.99
Oct-97	115.336	3.9	161.500	67.8294031012527	$5,511,225.00	$8,125,126.79
Nov-97	115.229	3.9	161.700	67.9134023620592	$5,511,225.00	$8,115,077.15
Dec-97	115.461	3.9	161.800	67.9554019924625	$5,511,225.00	$8,110,061.66

Jan-98	115.633	3.7	162.000	68.0394012532690	$5,774,300.00	$8,486,700.20
Feb-98	116.370	3.6	162.000	68.0394012532690	$5,774,300.00	$8,486,700.20
Mar-98	115.830	3.6	162.000	68.0394012532690	$5,774,300.00	$8,486,700.20
Apr-98	115.859	3.5	162.200	68.1234005140755	$5,774,300.00	$8,476,235.71
May-98	116.127	3.6	162.600	68.2913990356885	$5,774,300.00	$8,455,383.96
Jun-98	116.104	3.8	162.800	68.3753982964950	$5,774,300.00	$8,444,996.51
Jul-98	116.193	3.7	163.200	68.5433968181080	$5,774,300.00	$8,424,297.99
Aug-98	115.846	3.8	163.400	68.6273960789145	$5,774,300.00	$8,413,986.73
Sep-98	116.102	3.4	163.500	68.6693957093178	$5,774,300.00	$8,408,840.56
Oct-98	116.224	3.3	163.900	68.8373942309308	$5,774,300.00	$8,388,318.68
Nov-98	116.156	3.1	164.100	68.9213934917373	$5,774,300.00	$8,378,095.26
Dec-98	117.040	2.9	164.400	69.0473923829471	$5,774,300.00	$8,362,806.76
Jan-99	116.955	3.0	164.700	69.1733912741568	$5,941,737.00	$8,589,628.02
Feb-99	116.564	3.0	164.700	69.1733912741568	$5,941,737.00	$8,589,628.02
Mar-99	117.074	2.7	164.800	69.2153909045601	$5,941,737.00	$8,584,415.87
Apr-99	117.329	3.1	165.900	69.6773868389958	$5,941,737.00	$8,527,496.90
May-99	117.282	3.0	166.000	69.7193864693991	$5,941,737.00	$8,522,359.85
Jun-99	117.815	3.1	166.000	69.7193864693991	$5,941,737.00	$8,522,359.85
Jul-99	119.286	3.2	166.700	70.0133838822218	$5,941,737.00	$8,486,573.10
Aug-99	119.433	3.0	167.100	70.1813824038349	$5,941,737.00	$8,466,258.14
Sep-99	119.637	3.1	167.800	70.4753798166576	$5,941,737.00	$8,430,940.02
Oct-99	120.171	3.1	168.100	70.6013787078674	$5,941,737.00	$8,415,893.72
Nov-99	120.649	3.0	168.400	70.7273775990771	$5,941,737.00	$8,400,901.04
Dec-99	120.844	3.0	168.800	70.8953761206902	$5,941,737.00	$8,380,993.69
Jan-00	120.149	3.8	169.300	71.1053742727064	$6,339,817.00	$8,916,086.96
Feb-00	120.088	3.8	170.000	71.3993716855292	$6,339,817.00	$8,879,373.66
Mar-00	120.241	3.7	171.000	71.8193679895617	$6,339,817.00	$8,827,447.49
Apr-00	120.804	3.4	170.900	71.7773683591585	$6,339,817.00	$8,832,612.76
May-00	121.139	3.6	171.200	71.9033672503682	$6,339,817.00	$8,817,135.06
Jun-00	121.449	3.4	172.200	72.3233635544007	$6,339,817.00	$8,765,932.18
Jul-00	120.907	3.5	172.700	72.5333617064170	$6,339,817.00	$8,740,553.11
Aug-00	120.605	3.6	172.700	72.5333617064170	$6,339,817.00	$8,740,553.11
Sep-00	121.516	3.6	173.600	72.9113583800463	$6,339,817.00	$8,695,239.18
Oct-00	121.998	3.6	173.900	73.0373572712560	$6,339,817.00	$8,680,238.77
Nov-00	122.573	3.4	174.200	73.1633561624658	$6,339,817.00	$8,665,290.02
Dec-00	122.154	3.3	174.600	73.3313546840788	$6,339,817.00	$8,645,438.27
Jan-01	122.980	3.4	175.600	73.7513509881113	$6,264,136.00	$8,493,588.14
Feb-01	123.250	3.3	176.000	73.9193495097243	$6,264,136.00	$8,474,284.53
Mar-01	123.334	3.5	176.100	73.9613491401276	$6,264,136.00	$8,469,472.33
Apr-01	124.001	3.5	176.400	74.0873480313373	$6,264,136.00	$8,455,068.47
May-01	123.914	3.5	177.300	74.4653447049666	$6,264,136.00	$8,412,149.34
Jun-01	124.170	3.6	177.700	74.6333432265796	$6,264,136.00	$8,393,213.72
Jul-01	123.570	3.6	177.400	74.5073443353699	$6,264,136.00	$8,407,407.43
Aug-01	123.922	3.8	177.400	74.5073443353699	$6,264,136.00	$8,407,407.43
Sep-01	123.309	3.9	178.100	74.8013417481926	$6,264,136.00	$8,374,363.15
Oct-01	122.989	4.0	177.600	74.5913435961764	$6,264,136.00	$8,397,939.62
Nov-01	122.752	4.1	177.500	74.5493439657731	$6,264,136.00	$8,402,670.86
Dec-01	123.161	4.2	177.400	74.5073443353699	$6,264,136.00	$8,407,407.43
Jan-02	122.950	4.1	177.700	74.6333432265796	$6,536,679.00	$8,758,389.64
Feb-02	122.701	4.0	178.000	74.7593421177894	$6,536,679.00	$8,743,628.31
Mar-02	122.593	4.2	178.500	74.9693402698056	$6,536,679.00	$8,719,136.35
Apr-02	121.907	4.4	179.300	75.3053373130317	$6,536,679.00	$8,680,233.34
May-02	121.925	4.4	179.500	75.3893365738382	$6,536,679.00	$8,670,561.78
Jun-02	121.667	4.5	179.600	75.4313362042414	$6,536,679.00	$8,665,734.07
Jul-02	122.212	4.5	180.000	75.5993347258544	$6,536,679.00	$8,646,476.88
Aug-02	122.104	4.4	180.500	75.8093328778707	$6,536,679.00	$8,622,525.42
Sep-02	121.558	4.5	180.800	75.9353317690804	$6,536,679.00	$8,608,218.13
Oct-02	121.470	4.5	181.200	76.1033302906934	$6,536,679.00	$8,589,215.45
Nov-02	122.009	4.7	181.500	76.2293291819032	$6,536,679.00	$8,575,018.40
Dec-02	121.775	4.7	181.800	76.3553280731130	$6,536,679.00	$8,560,868.20
Jan-03	122.158	4.7	182.600	76.6913251163390	$6,945,273.00	$9,056,139.00
Feb-03	121.937	4.8	183.600	77.1113214203715	$6,945,273.00	$9,006,813.62
Mar-03	122.314	4.5	183.900	77.2373203115813	$6,945,273.00	$8,992,120.61
Apr-03	121.867	4.8	183.200	76.9433228987585	$6,945,273.00	$9,026,479.15
May-03	121.408	5.0	182.900	76.8173240075487	$6,945,273.00	$9,041,284.75
Jun-03	121.174	5.0	183.100	76.9013232683552	$6,945,273.00	$9,031,408.96
Jul-03	120.491	5.0	183.700	77.1533210507748	$6,945,273.00	$9,001,910.62
Aug-03	120.883	5.1	184.500	77.4893180940008	$6,945,273.00	$8,962,877.94
Sep-03	121.460	5.1	185.100	77.7413158764203	$6,945,273.00	$8,933,824.85
Oct-03	121.331	4.9	184.900	77.6573166156138	$6,945,273.00	$8,943,488.27
Nov-03	121.510	4.8	185.000	77.6993162460170	$6,945,273.00	$8,938,653.95
Dec-03	121.813	4.7	185.500	77.9093143980333	$6,945,273.00	$8,914,560.54
Jan-04	121.429	4.7	186.300	78.2453114412593	$7,188,257.00	$9,186,821.38
Feb-04	121.621	4.6	186.700	78.4133099628723	$7,188,257.00	$9,167,138.85
Mar-04	121.810	4.6	187.100	78.5813084844853	$7,188,257.00	$9,147,540.48
Apr-04	122.879	4.4	187.400	78.7073073756951	$7,188,257.00	$9,132,896.60
May-04	123.677	4.4	188.200	79.0433044189211	$7,188,257.00	$9,094,074.51
Jun-04	123.624	4.4	188.900	79.3373018317439	$7,188,257.00	$9,060,374.92
Jul-04	123.359	4.4	189.100	79.4213010925504	$7,188,257.00	$9,050,792.30
Aug-04	123.404	4.4	189.200	79.4633007229536	$7,188,257.00	$9,046,008.58
Sep-04	123.618	4.4	189.800	79.7152985053732	$7,188,257.00	$9,017,412.13
Oct-04	122.424	4.6	190.800	80.1352948094057	$7,188,257.00	$8,970,151.06
Nov-04	122.900	4.6	191.700	80.5132914830349	$7,188,257.00	$8,928,037.68
Dec-04	123.162	4.7	191.700	80.5132914830349	$7,188,257.00	$8,928,037.68
Jan-05	123.998	4.4	191.600	80.4712918526317	$7,624,985.00	$9,475,410.20
Feb-05	124.417	4.5	192.400	80.8072888958577	$7,624,985.00	$9,436,011.41
Mar-05	124.605	4.3	193.100	81.1012863086805	$7,624,985.00	$9,401,805.26
Apr-05	124.052	4.4	193.700	81.3532840911000	$7,624,985.00	$9,372,682.47
May-05	124.351	4.2	193.600	81.3112844606968	$7,624,985.00	$9,377,523.74
Jun-05	124.954	4.1	193.700	81.3532840911000	$7,624,985.00	$9,372,682.47
Jul-05	124.655	4.0	194.900	81.8572796559390	$7,624,985.00	$9,314,974.83
Aug-05	124.715	4.1	196.100	82.3612752207781	$7,624,985.00	$9,257,973.46
Sep-05	125.402	3.9	198.800	83.4952652416659	$7,624,985.00	$9,132,236.39
Oct-05	124.706	3.9	199.100	83.6212641328756	$7,624,985.00	$9,118,476.12
Nov-05	124.700	4.0	198.100	83.2012678288431	$7,624,985.00	$9,164,505.78
Dec-05	125.260	4.1	198.100	83.2012678288431	$7,624,985.00	$9,164,505.78
Jan-06	125.140	3.9	199.300	83.7052633936821	$8,026,285.00	$9,588,745.89
Feb-06	125.530	4.0	199.400	83.7472630240854	$8,026,285.00	$9,583,937.09
Mar-06	125.823	4.5	199.700	83.8732619152951	$8,026,285.00	$9,569,539.58
Apr-06	125.800	4.3	200.700	84.2932582193277	$8,026,285.00	$9,521,858.77
May-06	125.860	4.1	201.300	84.5452560017472	$8,026,285.00	$9,493,477.67
Jun-06	125.971	4.1	201.800	84.7552541537635	$8,026,285.00	$9,469,955.67
Jul-06	125.807	4.0	202.900	85.2172500881992	$8,026,285.00	$9,418,615.35
Aug-06	126.577	4.0	203.800	85.5952467618285	$8,026,285.00	$9,377,021.86
Sep-06	127.200	3.9	202.800	85.1752504577960	$8,026,285.00	$9,423,259.64

Oct-06	126.547	3.8	201.900	84.7972537841667	$8,026,285.00	$9,465,265.26
Nov-06	127.153	3.7	202.000	84.8392534145700	$8,026,285.00	$9,460,579.48
Dec-06	127.214	3.4	203.100	85.3012493490057	$8,026,285.00	$9,409,340.50
Jan-07	126.501	3.7	203.437	85.4427881034647	$8,551,715.00	$10,008,703.12
Feb-07	126.602	3.7	204.226	85.7741651873464	$8,551,715.00	$9,970,035.83
Mar-07	126.222	3.9	205.288	86.2202012622289	$8,551,715.00	$9,918,458.64
Apr-07	126.020	3.6	205.904	86.4789189855129	$8,551,715.00	$9,888,785.73
May-07	126.100	3.3	206.755	86.8363358402446	$8,551,715.00	$9,848,083.66
Jun-07	126.601	3.6	207.234	87.0375140698762	$8,551,715.00	$9,825,320.83
Jul-07	127.196	3.6	207.603	87.1924927060642	$8,551,715.00	$9,807,857.00
Aug-07	127.468	3.4	207.667	87.2193724695223	$8,551,715.00	$9,804,834.36
Sep-07	127.236	3.6	208.547	87.5889692170709	$8,551,715.00	$9,763,461.17
Oct-07	127.181	3.6	209.190	87.8590268405638	$8,551,715.00	$9,733,450.63
Nov-07	127.454	3.6	210.834	88.5495007643933	$8,551,715.00	$9,657,553.04
Dec-07	127.489	3.7	211.445	88.8061185061572	$8,551,715.00	$9,629,646.18
Jan-08	128.602	3.5	212.174	89.1122958117969	$9,135,499.00	$10,251,670.57
Feb-08	128.896	3.3	212.687	89.3277539157656	$9,135,499.00	$10,226,943.59
Mar-08	128.775	3.5	213.448	89.6473711031343	$9,135,499.00	$10,190,481.76
Apr-08	129.433	3.4	213.942	89.8548492773264	$9,135,499.00	$10,166,951.56
May-08	129.566	3.6	215.208	90.3865645982315	$9,135,499.00	$10,107,142.63
Jun-08	129.708	3.7	217.463	91.3336562638249	$9,135,499.00	$10,002,335.80
Jul-08	130.329	3.8	219.016	91.9859105239874	$9,135,499.00	$9,931,411.18
Aug-08	130.095	3.9	218.690	91.8489917288728	$9,135,499.00	$9,946,215.88
Sep-08	130.107	3.9	218.877	91.9275310377269	$9,135,499.00	$9,937,718.22
Oct-08	130.006	4.0	216.995	91.1370979935377	$9,135,499.00	$10,023,908.16
Nov-08	129.576	4.1	213.153	89.5234721934447	$9,135,499.00	$10,204,585.21
Dec-08	130.654	4.1	211.398	88.7863786798676	$9,135,499.00	$10,289,302.41
Jan-09	129.678	4.5	211.933	89.0110767025250	$9,147,189.00	$10,276,461.47
Feb-09	129.086	4.7	212.705	89.3353138492381	$9,147,189.00	$10,239,163.67
Mar-09	128.678	4.7	212.495	89.2471146253913	$9,147,189.00	$10,249,282.61
Apr-09	128.182	4.7	212.709	89.3369938344543	$9,147,189.00	$10,238,971.12
May-09	127.921	5.2	213.022	89.4684526776165	$9,147,189.00	$10,223,926.68
Jun-09	128.194	5.6	214.790	90.2110061431460	$9,147,189.00	$10,139,770.51
Jul-09	128.395	5.7	214.726	90.1841263796879	$9,147,189.00	$10,142,792.71
Aug-09	127.774	5.8	215.445	90.4861037222873	$9,147,189.00	$10,108,943.39
Sep-09	127.957	5.9	215.861	90.6608221847648	$9,147,189.00	$10,089,461.78
Oct-09	127.525	5.9	216.509	90.9329797897779	$9,147,189.00	$10,059,264.55
Nov-09	127.657	6.0	217.234	91.2374771102015	$9,147,189.00	$10,025,692.61
Dec-09	127.208	6.1	217.347	91.2849366925571	$9,147,189.00	$10,020,480.19
Jan-10	126.971	6.4	217.488	91.3441561714257	$9,622,215.00	$10,534,023.63
Feb-10	126.988	6.5	217.281	91.2572169364910	$9,622,215.00	$10,544,059.22
Mar-10	127.344	6.5	217.353	91.2874566703813	$9,622,215.00	$10,540,566.42
Apr-10	127.840	6.7	217.403	91.3084564855829	$9,622,215.00	$10,538,142.22
May-10	128.296	6.2	217.290	91.2609969032273	$9,622,215.00	$10,543,622.50
Jun-10	128.404	5.9	217.199	91.2227772395603	$9,622,215.00	$10,548,039.96
Jul-10	127.791	6.0	217.605	91.3932957389975	$9,622,215.00	$10,528,359.79
Aug-10	127.641	6.2	217.923	91.5268545636799	$9,622,215.00	$10,512,996.48
Sep-10	127.885	6.1	218.275	91.6746932626993	$9,622,215.00	$10,496,042.75
Oct-10	129.118	6.3	219.035	91.9938904537640	$9,622,215.00	$10,459,623.95
Nov-10	129.084	6.7	219.590	92.2269884025021	$9,622,215.00	$10,433,187.91
Dec-10	129.973	6.4	220.472	92.5974251426588	$9,622,215.00	$10,391,449.85
Jan-11	130.592	6.1	221.187	92.8977225000420	$10,073,563.00	$10,843,713.63
Feb-11	130.107	6.1	221.898	93.1963398722091	$10,073,563.00	$10,808,968.48
Mar-11	130.816	5.9	223.046	93.6784956292385	$10,073,563.00	$10,753,335.58
Apr-11	130.543	6.3	224.093	94.1182317595605	$10,073,563.00	$10,703,094.20
May-11	130.193	6.1	224.806	94.4176891243357	$10,073,563.00	$10,669,148.01
Jun-11	130.247	6.0	224.806	94.4176891243357	$10,073,563.00	$10,669,148.01
Jul-11	129.765	6.1	225.395	94.6650669474109	$10,073,563.00	$10,641,267.50
Aug-11	130.047	6.1	226.106	94.9636843195780	$10,073,563.00	$10,607,805.58
Sep-11	129.852	6.2	226.597	95.1699025048580	$10,073,563.00	$10,584,820.13
Oct-11	129.771	6.1	226.750	95.2341619393750	$10,073,563.00	$10,577,678.00
Nov-11	130.256	5.9	227.169	95.4101403907646	$10,073,563.00	$10,558,168.09
Dec-11	130.394	5.8	227.223	95.4328201911823	$10,073,563.00	$10,555,658.92
Jan-12	129.970	5.7	227.860	95.7003578368511	$10,747,714.00	$11,230,589.15
Feb-12	130.271	5.7	228.377	95.9174959260359	$10,747,714.00	$11,205,165.33
Mar-12	129.983	5.8	228.894	96.1346340152207	$10,747,714.00	$11,179,856.37
Apr-12	130.662	5.6	229.286	96.2992725664014	$10,747,714.00	$11,160,742.67
May-12	130.990	5.5	228.722	96.0623946509271	$10,747,714.00	$11,188,263.67
Jun-12	131.600	5.4	228.506	95.9716754492561	$10,747,714.00	$11,198,839.61
Jul-12	131.194	5.4	228.475	95.9586555638311	$10,747,714.00	$11,200,359.09
Aug-12	131.601	5.3	229.844	96.5336305040516	$10,747,714.00	$11,133,647.36
Sep-12	131.620	5.0	230.987	97.0136862795607	$10,747,714.00	$11,078,554.39
Oct-12	131.932	5.1	231.655	97.2942438106545	$10,747,714.00	$11,046,608.29
Nov-12	132.537	5.0	231.278	97.1359052040342	$10,747,714.00	$11,064,615.06
Dec-12	132.706	5.2	231.272	97.1333852262100	$10,747,714.00	$11,064,902.12
Jan-13	132.666	5.4	231.641	97.2883638623980	$11,034,893.00	$11,342,459.22
Feb-13	133.546	5.2	233.005	97.8612388210984	$11,034,893.00	$11,276,061.02
Mar-13	133.585	5.3	232.313	97.5706013787079	$11,034,893.00	$11,309,649.47
Apr-13	134.195	5.1	231.856	97.3786630677650	$11,034,893.00	$11,331,941.36
May-13	134.592	5.1	231.895	97.3950429236223	$11,034,893.00	$11,330,035.56
Jun-13	134.535	5.0	232.357	97.5890812160853	$11,034,893.00	$11,307,507.83
Jul-13	135.294	4.8	232.749	97.7537197672661	$11,034,893.00	$11,288,463.52
Aug-13	135.725	4.7	233.249	97.9637179192823	$11,034,893.00	$11,264,265.21
Sep-13	135.579	4.7	233.642	98.1287764667671	$11,034,893.00	$11,245,318.04
Oct-13	135.404	4.7	233.799	98.1947158865002	$11,034,893.00	$11,237,766.62
Nov-13	135.828	4.6	234.21	98.3673343674576	$11,034,893.00	$11,218,046.18
Dec-13	135.344	4.4	234.847	98.6348720131263	$11,034,893.00	$11,187,618.31
Jan-14	135.689	4.3	235.436	98.8822498362015	$11,441,626.00	$11,570,960.43
Feb-14	136.209	4.4	235.621	98.9599491524475	$11,441,626.00	$11,561,875.38
Mar-14	136.462	4.2	235.897	99.0758681323604	$11,441,626.00	$11,548,347.96
Apr-14	136.560	4.0	236.495	99.3270259221719	$11,441,626.00	$11,519,146.87
May-14	136.872	4.0	236.803	99.4563847838139	$11,441,626.00	$11,504,164.39
Jun-14	136.972	3.9	237.016	99.5458439965728	$11,441,626.00	$11,493,825.90
Jul-14	137.243	4.0	237.259	99.6479030984527	$11,441,626.00	$11,482,053.96
Aug-14	137.256	4.0	237.163	99.6075834532656	$11,441,626.00	$11,486,701.72
Sep-14	137.142	3.8	237.51	99.7533221707649	$11,441,626.00	$11,469,919.75
Oct-14	138.044	3.7	237.651	99.8125416496335	$11,441,626.00	$11,463,114.57
Nov-14	137.709	3.7	237.261	99.6487430910608	$11,441,626.00	$11,481,957.17
Dec-14	138.376	3.4	236.464	99.3140060367469	$11,441,626.00	$11,520,657.01
Jan-15	139.003	3.7	234.954	98.6798116176578		
Feb-15	139.102	3.5	235.415	98.8734299138168		
Mar-15	139.442	3.4	235.859	99.0599082728072		
Apr-15	139.759	3.4	236.197	99.2018670235702		
May-15	139.452	3.5	236.876	99.4870445140083		
Jun-15	139.800	3.5	237.423	99.7167824923141		

Jul-15	140.853	3.4	237.734	99.8474013428682
Aug-15	140.742	3.4	237.703	99.8343814574432
Sep-15	141.129	3.4	237.489	99.7445022483802
Oct-15	141.007	3.5	237.949	99.9377005482352
Nov-15	141.164	3.5	238.302	100.0859592435590
Dec-15	141.386	3.4	238.041	99.9763402082062
Jan-16	141.270	3.3	238.107	100.0040599642720
Feb-16	141.436	3.3	237.707	99.8360614426593
Mar-16	141.307	3.3	237.920	99.9255206554182
Apr-16	142.017	3.6	238.890	100.3329170703300
May-16	141.791	3.3	239.410	100.5513151484270
Jun-16	141.833	3.7	239.927	100.7684532376120
Jul-16	141.417	4.2	239.828	100.7268736035120

Table A2. *Quarterly Data*

Date	CPI-U: All Items (Quarterly)	CPI (Q4:2015 = 100)	**Nominal Retail Sales**	**Real Retail Sales** Base Period (Q4:2015)	**Nominal Total Wages**	**Real Total Wages** Base Period (Q4:2015)
Q1-90	128.033	53.7735267929642	$722,623,502.38	$1,343,827,614.59	$457,397,967.12	$850,600,647.57
Q2-90	129.300	54.3055221114054	$775,774,395.47	$1,428,536,850.97	$461,898,005.10	$850,554,395.10
Q3-90	131.533	55.2435138570781	$727,100,161.58	$1,316,172,905.76	$468,590,810.86	$848,227,743.22
Q4-90	133.767	56.1815056027507	$833,590,747.72	$1,483,745,831.97	$468,329,615.35	$833,601,040.64
Q1-91	134.767	56.6015019067832	$850,499,175.44	$1,502,608,847.44	$477,851,548.05	$844,238,283.35
Q2-91	135.567	56.9374989500092	$807,325,699.24	$1,417,915,634.03	$481,859,213.20	$846,295,011.34
Q3-91	136.600	57.3714951308429	$824,222,981.49	$1,436,641,976.32	$486,354,133.00	$847,727,833.98
Q4-91	137.733	57.8474909420797	$776,673,135.54	$1,342,621,992.58	$478,474,982.71	$827,131,782.07
Q1-92	138.667	58.2394874925101	$823,925,092.79	$1,414,718,996.10	$498,312,769.42	$855,626,982.44
Q2-92	139.733	58.6874835501448	$823,377,935.83	$1,402,987,291.36	$496,200,132.78	$845,495,670.91
Q3-92	140.800	59.1354796077795	$830,995,685.69	$1,405,240,460.04	$501,146,414.09	$847,454,721.62
Q4-92	142.033	59.6534750494196	$792,327,937.89	$1,328,217,571.96	$519,029,153.77	$870,073,626.63
Q1-93	143.067	60.0874712302532	$856,606,231.45	$1,425,598,737.83	$505,763,238.11	$841,711,637.64
Q2-93	144.100	60.5214674110868	$922,785,589.34	$1,524,724,414.01	$526,886,954.68	$870,578,618.16
Q3-93	144.767	60.8014649471085	$978,050,120.64	$1,608,596,308.47	$534,046,956.54	$878,345,541.52
Q4-93	145.967	61.3054605119475	$1,067,259,310.44	$1,740,887,845.11	$553,949,094.44	$903,588,505.52
Q1-94	146.700	61.6134578015714	$983,059,467.03	$1,595,527,182.06	$538,838,003.62	$874,545,956.10
Q2-94	147.533	61.9634547215985	$1,007,761,483.43	$1,626,380,401.09	$549,102,638.88	$886,171,762.61
Q3-94	148.900	62.5374496704429	$1,028,769,617.60	$1,645,045,685.46	$572,412,705.28	$915,311,878.39
Q4-94	149.767	62.9014464672711	$1,174,097,466.65	$1,866,566,720.79	$572,640,707.87	$910,377,646.35
Q1-95	150.867	63.3634424017069	$995,305,215.80	$1,570,787,788.78	$581,444,523.02	$917,634,050.45
Q2-95	152.100	63.8814378433470	$1,067,769,055.80	$1,671,485,633.15	$587,055,300.19	$918,976,341.19
Q3-95	152.867	64.2034350097719	$1,058,838,482.24	$1,649,192,885.21	$587,247,527.60	$914,666,835.99
Q4-95	153.700	64.5534319297990	$1,050,653,590.02	$1,627,572,010.68	$598,844,500.93	$927,672,600.86
Q1-96	155.067	65.1274268786435	$1,025,426,818.45	$1,574,493,063.21	$620,574,360.70	$952,861,782.57
Q2-96	156.400	65.6874219506868	$1,036,844,062.67	$1,578,451,447.60	$615,230,350.39	$936,602,978.34
Q3-96	157.300	66.0654186243161	$1,045,270,303.91	$1,582,174,647.00	$621,764,332.10	$941,134,325.72
Q4-96	158.667	66.6394135731606	$1,037,222,360.30	$1,556,469,819.71	$633,736,934.93	$950,994,165.39
Q1-97	159.633	67.0454100003920	$1,241,455,550.94	$1,851,663,746.90	$640,908,341.94	$955,931,721.40
Q2-97	160.000	67.1994086452039	$1,124,351,412.90	$1,673,156,707.13	$652,170,721.80	$970,500,685.86
Q3-97	160.800	67.5354056884300	$1,187,297,429.44	$1,758,037,013.83	$663,905,301.38	$983,047,772.67
Q4-97	161.667	67.8994024852581	$1,178,888,223.00	$1,736,227,683.67	$683,763,481.14	$1,007,024,297.87
Q1-98	162.000	68.0394012532690	$1,183,048,116.25	$1,738,769,146.20	$680,683,150.81	$1,000,424,957.12
Q2-98	162.533	68.2633992820863	$1,124,473,143.16	$1,647,256,296.91	$713,354,715.86	$1,045,003,213.08
Q3-98	163.367	68.6133962021134	$1,095,725,870.49	$1,596,956,179.31	$703,709,116.37	$1,025,614,756.47
Q4-98	164.133	68.9353933685384	$1,162,585,650.59	$1,686,485,843.89	$720,499,256.02	$1,045,180,452.03
Q1-99	164.733	69.1873911509579	$1,133,007,074.00	$1,637,591,843.18	$684,400,453.48	$989,198,236.98
Q2-99	165.967	69.7053865925980	$1,127,191,441.87	$1,617,079,392.24	$710,274,516.23	$1,018,966,468.66
Q3-99	167.200	70.2233820342381	$1,148,343,605.12	$1,635,272,429.00	$721,604,519.55	$1,027,584,400.88
Q4-99	168.433	70.7413774758782	$1,115,415,678.03	$1,576,751,425.87	$746,239,045.80	$1,054,883,396.99
Q1-00	170.100	71.4413713159324	$1,232,797,520.37	$1,725,607,302.41	$773,016,449.54	$1,082,029,131.44
Q2-00	171.433	72.0013663879758	$1,230,504,582.49	$1,709,001,709.58	$773,146,680.57	$1,073,794,456.07
Q3-00	173.000	72.6593605976268	$1,104,443,035.75	$1,520,028,564.34	$777,360,495.83	$1,069,869,717.32
Q4-00	174.233	73.1773560392669	$1,172,457,899.71	$1,602,214,077.10	$782,951,647.33	$1,069,937,053.90
Q1-01	175.900	73.8773498793211	$1,039,161,379.39	$1,406,603,486.84	$800,172,318.58	$1,083,109,125.99
Q2-01	177.133	74.3953453209612	$1,099,468,551.51	$1,477,872,771.16	$797,190,164.18	$1,071,559,196.00
Q3-01	177.633	74.6053434729775	$1,084,857,141.54	$1,454,127,936.47	$809,655,138.12	$1,085,250,868.68
Q4-01	177.500	74.5493439657731	$1,130,524,173.73	$1,516,477,695.97	$804,326,954.77	$1,078,918,890.47
Q1-02	178.067	74.7873418713916	$ 851,791,801.84	$1,138,951,834.00	$813,282,151.33	$1,087,459,630.18
Q2-02	179.467	75.3753366970371	$872,534,736.90	$1,157,586,519.86	$824,986,078.52	$1,094,504,004.46
Q3-02	180.433	75.7813331242685	$887,221,562.36	$1,170,765,313.55	$839,213,656.92	$1,107,414,744.93
Q4-02	181.500	76.2293291819032	$828,624,707.05	$1,087,015,609.27	$830,567,980.29	$1,089,564,855.42
Q1-03	183.367	77.0133222827639	$876,258,000.89	$1,137,800,545.30	$842,121,244.75	$1,093,474,764.87
Q2-03	183.067	76.8873233915542	$872,725,524.23	$1,135,070,757.75	$838,564,971.97	$1,090,641,389.21
Q3-03	184.433	77.4613183403986	$872,070,306.22	$1,125,813,922.23	$843,807,838.35	$1,089,328,010.98
Q4-03	185.133	77.7553157532214	$882,763,911.81	$1,135,310,046.98	$838,658,096.43	$1,078,586,188.36
Q1-04	186.700	78.4133099628723	$934,700,574.70	$1,192,017,752.02	$857,671,307.14	$1,093,782,812.57
Q2-04	188.167	79.0293045421200	$942,696,204.96	$1,192,843,857.63	$858,683,964.77	$1,086,538,683.01
Q3-04	189.367	79.5333001069591	$948,991,992.64	$1,193,200,824.51	$877,192,784.12	$1,102,925,168.38
Q4-04	191.400	80.3872925918252	$942,882,015.80	$1,172,924,209.04	$898,774,417.35	$1,118,055,339.81
Q1-05	192.367	80.7932890190566	$945,361,363.61	$1,170,098,872.19	$889,668,048.12	$1,101,165,776.17
Q2-05	193.667	81.3392842142989	$956,626,569.68	$1,176,094,157.85	$911,409,816.97	$1,120,503,857.12
Q3-05	196.600	82.5712733727943	$988,814,122.15	$1,197,528,004.31	$946,547,755.97	$1,146,340,267.39
Q4-05	198.433	83.3412665968539	$1,012,685,587.93	$1,215,107,028.35	$935,932,377.26	$1,123,011,942.92
Q1-06	199.467	83.7752627776876	$1,015,335,193.28	$1,211,974,942.97	$996,627,413.36	$1,189,644,031.32
Q2-06	201.267	84.5312561249461	$1,044,340,855.56	$1,235,449,351.44	$989,333,111.90	$1,170,375,500.44
Q3-06	203.167	85.3292491026079	$1,014,369,581.11	$1,188,771,249.93	$974,502,638.85	$1,142,049,940.78
Q4-06	202.333	84.9792521825808	$1,048,528,442.51	$1,233,864,049.85	$987,119,103.08	$1,161,600,129.12
Q1-07	204.317	85.8123848510133	$1,076,253,845.53	$1,254,194,073.96	$992,303,578.47	$1,156,364,061.20
Q2-07	206.631	86.7842562985446	$1,085,298,968.10	$1,250,571,260.72	$1,010,326,848.15	$1,164,182,181.47
Q3-07	207.939	87.3336114642191	$1,079,314,939.33	$1,235,852,864.93	$1,017,545,576.10	$1,165,124,811.68
Q4-07	210.490	88.4048820370381	$1,078,306,431.93	$1,219,736,294.06	$1,036,109,741.34	$1,172,005,117.21
Q1-08	212.770	89.3624736102322	$1,145,600,949.85	$1,281,970,947.72	$1,064,476,569.32	$1,191,189,686.58
Q2-08	215.538	90.5250233797943	$1,140,085,961.49	$1,259,415,263.23	$1,068,130,869.95	$1,179,928,852.89
Q3-08	218.861	91.9208110968624	$1,110,133,938.60	$1,207,706,856.97	$1,084,222,511.62	$1,179,517,998.90
Q4-08	213.849	89.8156496222833	$1,055,423,926.79	$1,175,100,253.94	$1,081,795,656.17	$1,204,462,318.89
Q1-09	212.378	89.1978350590515	$1,006,086,110.58	$1,127,926,602.61	$1,080,532,735.67	$1,211,388,970.32
Q2-09	213.507	89.6721508850722	$1,012,854,592.51	$1,129,508,529.14	$1,071,214,747.93	$1,194,590,223.79
Q3-09	215.344	90.4436840955800	$1,058,193,032.26	$1,170,002,132.09	$1,069,149,814.51	$1,182,116,612.34
Q4-09	217.030	91.1517978641788	$1,065,491,146.96	$1,168,919,507.82	$1,092,659,853.90	$1,198,725,510.09
Q1-10	217.374	91.2962765927660	$1,071,823,010.02	$1,174,005,173.07	$1,069,258,185.30	$1,171,195,830.98
Q2-10	217.297	91.2640768761235	$1,101,007,517.84	$1,206,397,473.71	$1,113,261,995.50	$1,219,824,966.85
Q3-10	217.934	91.5316145217922	$1,060,495,174.14	$1,158,610,803.14	$1,096,155,503.84	$1,197,570,379.99
Q4-10	219.699	92.2727679996416	$1,124,777,986.86	$1,218,970,679.26	$1,150,835,849.04	$1,247,210,714.48
Q1-11	222.044	93.2575193338299	$1,141,461,244.56	$1,223,988,427.65	$1,116,630,301.81	$1,197,362,217.86
Q2-11	224.568	94.3178700027440	$1,188,152,936.45	$1,259,732,579.22	$1,156,929,008.02	$1,226,627,581.80
Q3-11	226.033	94.9328845906156	$1,173,397,183.63	$1,236,028,156.83	$1,169,495,587.31	$1,231,918,309.82
Q4-11	227.047	95.3590408404406	$1,188,492,250.55	$1,246,334,107.47	$1,115,410,358.46	$1,169,695,446.42
Q1-12	228.377	95.9174959260359	$1,260,182,044.67	$1,313,818,748.60	$1,184,492,169.56	$1,234,907,310.83
Q2-12	228.838	96.1111142221949	$1,290,202,989.24	$1,342,407,691.02	$1,175,467,521.69	$1,223,029,751.76
Q3-12	229.769	96.5019907824811	$1,288,976,720.61	$1,335,699,616.30	$1,202,813,130.65	$1,246,412,764.03
Q4-12	231.402	97.1878447469662	$1,288,265,347.32	$1,325,541,636.07	$1,226,365,765.91	$1,261,850,974.37
Q1-13	232.320	97.5734013540681	$1,304,032,383.51	$1,336,462,975.99	$1,232,971,620.41	$1,263,634,969.47
Q2-13	232.036	97.4542624024909	$1,312,957,913.58	$1,347,255,503.46	$1,238,736,728.40	$1,271,095,484.03
Q3-13	233.213	97.9487380511052	$1,290,610,203.57	$1,317,638,419.09	$1,264,233,462.85	$1,290,709,291.41
Q4-13	234.285	98.3989740890280	$1,567,792,589.60	$1,593,301,763.68	$1,260,179,702.74	$1,280,683,781.92
Q1-14	235.651	98.9726890403365	$1,322,070,917.82	$1,335,793,672.62	$1,314,551,784.75	$1,328,196,492.88
Q2-14	236.771	99.4430849008529	$1,393,287,968.81	$1,401,090,855.34	$1,306,902,986.19	$1,314,222,087.43
Q3-14	237.311	99.6696029074944	$1,471,917,164.95	$1,476,796,457.51	$1,336,377,997.41	$1,340,807,988.02
Q4-14	237.125	99.5917635924804	$1,450,191,541.74	$1,456,136,019.11	$1,334,488,571.84	$1,339,958,771.39

Q1-15	235.409	98.8710499347606	$1,408,840,694.31	$1,424,927,413.28	$1,358,764,002.24	$1,374,278,925.06
Q2-15	236.832	99.4685646766308	$1,393,229,405.99	$1,400,673,077.49	$1,374,718,537.92	$1,382,063,310.54
Q3-15	237.642	99.8087616828972	$1,330,952,080.08	$1,333,502,247.34	$1,391,287,052.37	$1,393,952,824.29
Q4-15	238.097	100	$1,312,994,764.54	$1,312,994,764.54	$1,427,270,033.09	$1,427,270,033.09

Table A3. *Lubbock Business Cycle Index*

Date	Business Cycle Index
Oct-90	99.54696
Nov-90	99.68792
Dec-90	99.71282
Jan-91	99.5577
Feb-91	99.24292
Mar-91	98.69675
Apr-91	98.34103
May-91	98.24249
Jun-91	98.05303
Jul-91	97.95148
Aug-91	97.72679
Sep-91	97.33164
Oct-91	97.29449
Nov-91	97.35037
Dec-91	97.58494
Jan-92	98.16464
Feb-92	98.35432
Mar-92	98.46617
Apr-92	98.7226
May-92	98.81159
Jun-92	99.33646
Jul-92	100
Aug-92	100.3515
Sep-92	100.8378
Oct-92	101.0104
Nov-92	101.0827
Dec-92	101.5741
Jan-93	102.0103
Feb-93	102.7883
Mar-93	103.7544
Apr-93	104.2369
May-93	104.7533
Jun-93	105.16
Jul-93	105.3072
Aug-93	105.8877
Sep-93	106.4438
Oct-93	106.7324
Nov-93	107.1519
Dec-93	107.0605
Jan-94	106.8717
Feb-94	107.2398
Mar-94	107.5054
Apr-94	108.0983
May-94	108.9233
Jun-94	109.2538
Jul-94	109.798
Aug-94	110.3207
Sep-94	110.5475
Oct-94	111.2913
Nov-94	111.9106
Dec-94	112.1562
Jan-95	112.6728
Feb-95	112.817
Mar-95	112.9247
Apr-95	113.59
May-95	113.853
Jun-95	114.1044
Jul-95	114.5003
Aug-95	114.4569
Sep-95	114.7415
Oct-95	114.9721
Nov-95	114.8853
Dec-95	115.1367
Jan-96	115.1601
Feb-96	115.2605
Mar-96	115.6829
Apr-96	115.6547
May-96	115.8399
Jun-96	116.1672
Jul-96	116.1501
Aug-96	116.5569
Sep-96	116.9258
Oct-96	117.1489
Nov-96	117.8104
Dec-96	118.2593
Jan-97	118.7174
Feb-97	119.3865
Mar-97	119.6786
Apr-97	120.0333
May-97	120.5798
Jun-97	121.0404
Jul-97	121.7586
Aug-97	122.3575
Sep-97	122.6041
Oct-97	123.0423
Nov-97	123.3237
Dec-97	123.5489
Jan-98	124.1962
Feb-98	124.5823
Mar-98	124.782
Apr-98	125.1433
May-98	125.0586
Jun-98	125.0558
Jul-98	125.225
Aug-98	125.1086
Sep-98	125.5011
Oct-98	125.9546
Nov-98	126.1392
Dec-98	126.6932
Jan-99	126.8368
Feb-99	126.7486
Mar-99	127.1143

Apr-99	127.2139
May-99	127.4379
Jun-99	128.1437
Jul-99	128.6972
Aug-99	129.3849
Sep-99	130.2128
Oct-99	130.6562
Nov-99	131.0249
Dec-99	131.0751
Jan-00	130.6339
Feb-00	130.6602
Mar-00	131.1229
Apr-00	131.6046
May-00	132.1364
Jun-00	132.2331
Jul-00	131.8691
Aug-00	131.7984
Sep-00	132.0099
Oct-00	132.4601
Nov-00	133.0942
Dec-00	133.3482
Jan-01	133.4667
Feb-01	133.59
Mar-01	133.5663
Apr-01	133.7505
May-01	133.9763
Jun-01	133.9236
Jul-01	133.7211
Aug-01	133.3282
Sep-01	132.7072
Oct-01	132.2372
Nov-01	131.9912
Dec-01	131.8035
Jan-02	131.6439
Feb-02	131.2746
Mar-02	130.5914
Apr-02	130.0173
May-02	129.6398
Jun-02	129.463
Jul-02	129.5894
Aug-02	129.4584
Sep-02	129.0856
Oct-02	128.7571
Nov-02	128.3448
Dec-02	128.2627
Jan-03	128.3872
Feb-03	128.3989
Mar-03	128.495
Apr-03	128.0971
May-03	127.4214
Jun-03	127.0045
Jul-03	126.6021
Aug-03	126.6867
Sep-03	127.1803
Oct-03	127.4463
Nov-03	127.7262
Dec-03	127.8054
Jan-04	127.6318
Feb-04	127.8269
Mar-04	128.2782
Apr-04	128.9493
May-04	129.7343
Jun-04	130.1181
Jul-04	130.1651
Aug-04	130.0577
Sep-04	129.7707
Oct-04	129.5802
Nov-04	129.7537
Dec-04	130.2815
Jan-05	130.9343
Feb-05	131.3487
Mar-05	131.6117
Apr-05	131.6516
May-05	131.7765
Jun-05	132.3188
Jul-05	132.6807
Aug-05	132.9694
Sep-05	133.3954
Oct-05	133.3182
Nov-05	133.3496
Dec-05	133.7705
Jan-06	133.8967
Feb-06	134.2119
Mar-06	134.5704
Apr-06	134.4466
May-06	134.649
Jun-06	134.8599
Jul-06	134.7112
Aug-06	135.2255
Sep-06	135.6473
Oct-06	135.6801
Nov-06	136.3037
Dec-06	136.3082
Jan-07	135.8561
Feb-07	135.9326
Mar-07	135.4868
Apr-07	135.4793
May-07	136.2091
Jun-07	136.3352
Jul-07	136.8578
Aug-07	137.2929
Sep-07	136.8002
Oct-07	136.9965
Nov-07	137.2391
Dec-07	137.3217

Jan-08	138.3642
Feb-08	138.7835
Mar-08	138.8032
Apr-08	139.31
May-08	139.0402
Jun-08	138.9988
Jul-08	139.3054
Aug-08	138.864
Sep-08	138.8658
Oct-08	138.8166
Nov-08	138.27
Dec-08	138.2326
Jan-09	137.6438
Feb-09	136.6908
Mar-09	136.2369
Apr-09	135.4288
May-09	134.6732
Jun-09	134.3648
Jul-09	133.8186
Aug-09	133.472
Sep-09	133.3536
Oct-09	132.9743
Nov-09	132.6561
Dec-09	132.2011
Jan-10	131.6501
Feb-10	131.5153
Mar-10	131.7568
Apr-10	132.3014
May-10	132.8774
Jun-10	133.1659
Jul-10	133.1047
Aug-10	132.8132
Sep-10	132.9716
Oct-10	133.3974
Nov-10	133.7635
Dec-10	134.5974
Jan-11	135.0823
Feb-11	135.1544
Mar-11	135.4731
Apr-11	135.2678
May-11	135.1243
Jun-11	135.2905
Jul-11	134.9803
Aug-11	134.9669
Sep-11	135.1483
Oct-11	135.1005
Nov-11	135.5375
Dec-11	135.8784
Jan-12	135.8277
Feb-12	136.1611
Mar-12	136.4711
Apr-12	136.7989
May-12	137.6067
Jun-12	138.102
Jul-12	138.3175
Aug-12	138.9445
Sep-12	139.2943
Oct-12	139.643
Nov-12	140.3911
Dec-12	140.593
Jan-13	140.9049
Feb-13	141.6234
Mar-13	141.8717
Apr-13	142.4863
May-13	143.2797
Jun-13	143.6337
Jul-13	144.4589
Aug-13	145.1664
Sep-13	145.3198
Oct-13	145.8365
Nov-13	146.1685
Dec-13	146.3038
Jan-14	146.9911
Feb-14	147.4666
Mar-14	147.9229
Apr-14	148.7245
May-14	149.0413
Jun-14	149.3907
Jul-14	149.954
Aug-14	150.077
Sep-14	150.5794
Oct-14	151.306
Nov-14	151.6438
Dec-14	152.4481
Jan-15	153.1493
Feb-15	153.4008
Mar-15	153.9754
Apr-15	154.2307
May-15	154.2749
Jun-15	154.9291
Jul-15	155.402
Aug-15	155.7336
Sep-15	156.2209
Oct-15	156.1382
Nov-15	156.1405
Dec-15	156.3537
Jan-16	156.2431
Feb-16	156.489
Mar-16	156.7324
Apr-16	156.6231
May-16	156.6747
Jun-16	156.2751
Jul-16	155.6657

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