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Metropolitan Business Cycle Analysis for Lubbock

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METROPOLITAN BUSINESS CYLCLE ANALYSIS FOR LUBBOCK

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Dedication

My thesis is dedicated, first and foremost, to my mother; secondly, to my four sisters, Cristilla, April, Leila, and Aliyah.

METROPOLITAN BUSINESS CYCLE ANALYSIS FOR LUBBOCK

by

MACIE ZAYNAH SUBIA, B.S.,

THESIS

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Abstract

The objective of this study is to develop a business cycle index (BCI) for Lubbock Metropolitan Statistical Area (MSA). The Stock and 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 total wages that begin in 1990 and includes the most current data available.

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Chapter 1: Introduction

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, and 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 and Watson (1998; 1999) methodology is used to create the index. Indicators utilized for this purpose include establishment employment, the unemployment rate, real retail sales, and real total wages. 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, and 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.

Chapter 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 and 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 and 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 and 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). The coincident 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 and Watson (1989; 1991; 1993) develop a dynamic single-index factor model using a Kalman filter. Stock and Watson (1989) construct the coincident index with the same indicators as the CB model but use a different employment

variable (Phillips, 2005). Stock and Watson statistically estimate the weights of the component series that best identifies a single, time-dependent, underlying factor (Stock and Watson, 1989). The process incorporates co-movements in the components and attempts to identify the underlying state of the economy (Cañas, Gilmer and 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 and Cañas, 2004).

Clayton-Matthews and Stock (1998/1999) apply this methodology to the Massachusetts economy to estimate coincident and leading indexes. The coincident indicators must exhibit co-movement 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 and 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-Matthews and 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, and Phillips (2003) develop a coincident index for the Houston metropolitan economy using the Stock and Watson model. The coincident index developed uses the indicators of establishment employment, unemployment rate, real retail sales, and real total wages. Additionally, the average growth rate of personal income is used to retrend the series. The coincident index is correlated with historical U.S. economic recessions and expansions. Cañas, Gilmer, and 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 follows the U.S. industrial production manufacturing index along with Ciudad Juarez maquiladora employment due to the high international involvement with Mexico.

Phillips and 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, retail sales, and real total wages 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 and Watson methodology has been applied to data for a variety of 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 and 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 retail sales, and real total wages.

Chapter 3: Data and Methodology

Stock and 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 structure of the Stock and Watson model is:

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

$$(2) D(L)\mu_t = \varepsilon_t$$

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

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 retail sales, and real total wages 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 co-movement 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 and Stock, 1998/1999). Growth in the state of the economy is modeled as a stationary autoregressive process. Phillips and 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 and 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 ΔC_t , μ_t , and their lags. The measurement equation relates the observed variables to the elements of the state vector (Stock and 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 and Watson, 1991). The transition equation for the state is thus given by:

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

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 an $n \times k$ matrix of zeros, and

$D_i = \text{diag}(d_{1i}, \dots, d_{ni})$, 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:

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

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 and Watson, 1989; 1991).

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

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

$$(7) \ Y_t = \beta + Z \alpha_t + \xi_t$$

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 $\mu_\alpha = (\delta 0_{1 \times (p+nk)})'$. The covariance matrix of ζ_t is $E\zeta_t\zeta_t' = \Sigma$. 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, \dots, y_τ) , let $E[\xi_t\xi_t'] = H$, $E[\zeta_t\zeta_t'] = \Sigma$, 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:

$$(8) \alpha_{t|t-1} = \mu_\alpha + T_t\alpha_{t-1|t-1}$$

$$(9) P_{t|t-1} = T_tP_{t-1|t-1}T_t' + R\Sigma R'$$

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:

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

$$(11) P_{t|t} = P_{t|t-1} - P_{t|t-1}Z'F_t^{-1}ZP_{t|t-1}$$

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

Clayton-Matthews and 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 prediction 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 prediction 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 and 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 and 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:

$$(12) \Delta X_t = \gamma(L)\Omega(L)\Delta C_t + \mu_t$$

where $\Omega(L) = 1 + 2L + 3L^2 + 2L^3 + L^4$ 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 and 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. NAICS was introduced in 1997 and is periodically revised to reflect changes in the industrial structure of the U.S. and North American economy. NAICS uses a six-digit hierarchical structure which allows greater coding flexibility than the four-digit structure of the SIC (BLS, 2016). Although combining the Standard Industrial Classification (SIC) system data with NAICS data for disaggregated estimates can produce biased estimates (Tebaldi and Kelly, 2012), this problem does not affect the employment portion of this study because the total number of jobs under both classification systems are always equivalent. 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 total nonfarm employment data series are early benchmarked using preliminary releases of the Quarterly Census of Employment and Wages (QCEW) from the Texas Workforce Commission (TWC). The data are seasonally adjusted with a two-step seasonal adjustment procedure proposed by Berger and Phillips (1993; 1994). The two-step seasonal adjustments to the data are completed 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 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 (U.S. Census, 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 TWC. Total wage data are seasonally adjusted with the X-12 procedure and then adjusted for inflation using Q4:2015 as the base period.

Chapter 4: Empirical Results

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 and 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 0.4016 and kurtosis of 2.0076. Real total wages increase steadily over the course of the sample period and display a skewness of 0.0263 and a kurtosis of 2.1634.

Table 1: Variables, Definitions, and Units of Measure

Variable	Description
Employment	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	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	Lubbock MSA Quarterly Retail Sales defined by NAICS, seasonally adjusted in quarter four 2015 dollars; Texas Comptroller of Public Accounts
Real Total Wages	Lubbock MSA Quarterly Total Wages for all industries, seasonally adjusted in quarter four 2015 dollars*; Texas Workforce Commission

*Wages represent total compensation paid during the calendar quarter, regardless of when services were performed. Included in wages are 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	Maximum	Minimum	Standard Deviation	Skewness	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 γ prefix represents the γ parameters from Equation (1). The t-statistics for employment, unemployment rate, real retail sales, and real total 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 Standard Error	t-statistic
bEMP	0.292286	0.0822606	3.55316***
bUR	-0.206015	0.0573209	-3.59407***
bRETSAL	0.0156561	0.00814259	1.92275**
bWAGES	0.0153468	0.0063326	2.42346***
arEMP1	-0.247013	0.0700078	-3.52837***
arUR1	-0.192626	0.062077	-3.10301***
arRETSAL1	-0.427811	0.0897932	-4.7644***
arWAGES1	-0.69825	0.101304	-6.89259***
arWAGES2	-0.213545	0.10132	-2.10763**
sEMP	0.840683	0.0528507	15.9067***
sUR	0.926229	0.0428639	21.6086***
sRETSAL	0.879936	0.0630693	13.9519***
sWAGES	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***

coinindxr5	0.611483	0.142066	4.30423***
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Sample period: Employment and Unemployment 01:1990 – 07:2016. Real Retail Sales and Real Total Wages Q1:1990 – Q4:2015.

*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 and 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 and 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-Statistic for 6-lag specification test, dependent variable is one-step ahead forecast error

Dependent Variables				
	eEMP	eUR	eRETSAL	eWAGES
eEMP	0.534485	2.17698**	1.48439	0.834579
eUR	0.479343	0.499904	0.490425	0.155985
eRETSAL	1.26506	0.591134	0.513299	0.988615
eWAGES	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
RETSAL	0.891985	0.534071	0.259539	1.04359
WAGES	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

*p<0.10; **p<0.05; ***p<0.01. Ho: Coefficients are jointly zero.

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 total 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 and Cañas, 2008).

Table 5: Cumulative dynamic multipliers

Variable	Multiplier	Share
Employment	1.45201	46.9889
Unemployment Rate	-0.789402	25.5461
Retail Sales	0.296703	9.60171
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 (refer to page 10). The coincident index is retrended 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 and Hamden, 2004). Shading in Figure 1 indicates the beginning and end of recessions for the U.S. based on the dates from the NBER.

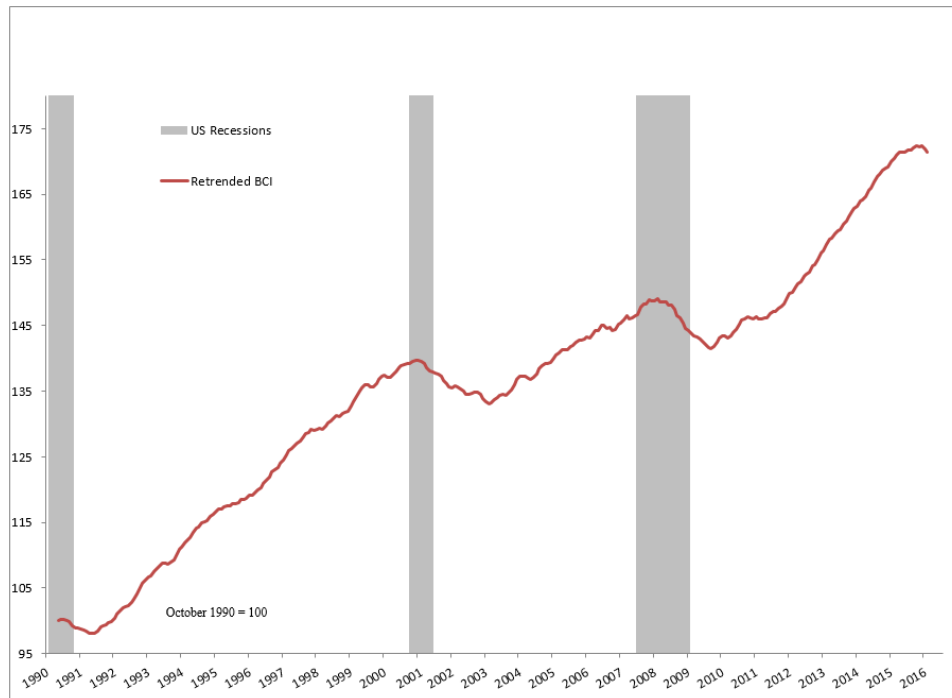


Figure 1: Lubbock BCI

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, and 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 total 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.

Chapter 5: Conclusion

This study employs the coincident index estimation procedure proposed by Stock and 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.

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Appendix: Data

Table 6: Monthly Data

Date	Employment (Thousands)	Unemployment (Percent)	CPI-U: All Items (Monthly)	CPI Base Period (Q4:2015)	Nominal Total Personal Income	Real Total Personal Income Base Period (Q4:2015)
Jan-90	97.731	4.7	127.500	53.5495	\$3,883,635	\$7,252,417
Feb-90	97.585	4.8	128.000	53.7595	\$3,883,635	\$7,224,087
Mar-90	98.544	4.7	128.600	54.0115	\$3,883,635	\$7,190,382
Apr-90	98.559	4.8	128.900	54.1375	\$3,883,635	\$7,173,647
May-90	99.129	4.9	129.100	54.2215	\$3,883,635	\$7,162,534
Jun-90	99.315	5.1	129.900	54.5575	\$3,883,635	\$7,118,423
Jul-90	99.164	5.2	130.500	54.8095	\$3,883,635	\$7,085,695
Aug-90	98.774	5.3	131.600	55.2715	\$3,883,635	\$7,026,468
Sep-90	99.456	5.5	132.500	55.6495	\$3,883,635	\$6,978,741
Oct-90	98.941	5.2	133.400	56.0275	\$3,883,635	\$6,931,658
Nov-90	98.941	5.1	133.700	56.1535	\$3,883,635	\$6,916,104
Dec-90	99.247	5.2	134.200	56.3635	\$3,883,635	\$6,890,336
Jan-91	98.882	4.7	134.700	56.5735	\$3,965,899	\$7,010,171
Feb-91	98.598	5.0	134.800	56.6155	\$3,965,899	\$7,004,970
Mar-91	98.200	5.2	134.800	56.6155	\$3,965,899	\$7,004,970
Apr-91	97.734	5.3	135.100	56.7415	\$3,965,899	\$6,989,415
May-91	98.127	5.5	135.600	56.9515	\$3,965,899	\$6,963,643
Jun-91	97.853	5.4	136.000	57.1195	\$3,965,899	\$6,943,162
Jul-91	97.563	5.5	136.200	57.2035	\$3,965,899	\$6,932,966
Aug-91	97.499	5.6	136.600	57.3715	\$3,965,899	\$6,912,665
Sep-91	97.243	5.6	137.000	57.5395	\$3,965,899	\$6,892,482
Oct-91	97.446	5.8	137.200	57.6235	\$3,965,899	\$6,882,434
Nov-91	97.728	6.0	137.800	57.8755	\$3,965,899	\$6,852,467
Dec-91	98.207	6.4	138.200	58.0435	\$3,965,899	\$6,832,634
Jan-92	98.705	5.9	138.300	58.0855	\$4,261,426	\$7,336,473
Feb-92	98.878	6.0	138.600	58.2115	\$4,261,426	\$7,320,593
Mar-92	98.890	6.0	139.100	58.4215	\$4,261,426	\$7,294,279
Apr-92	99.089	5.9	139.400	58.5475	\$4,261,426	\$7,278,581
May-92	99.115	5.8	139.700	58.6735	\$4,261,426	\$7,262,950
Jun-92	99.566	5.8	140.100	58.8415	\$4,261,426	\$7,242,214
Jul-92	100.295	5.6	140.500	59.0095	\$4,261,426	\$7,221,595
Aug-92	100.325	5.6	140.800	59.1355	\$4,261,426	\$7,206,209
Sep-92	100.778	5.7	141.100	59.2615	\$4,261,426	\$7,190,887
Oct-92	100.840	5.6	141.700	59.5135	\$4,261,426	\$7,160,439

Nov-92	100.951	5.7	142.100	59.6815	\$4,261,426	\$7,140,283
Dec-92	101.687	5.8	142.300	59.7655	\$4,261,426	\$7,130,247
Jan-93	100.905	5.3	142.800	59.9755	\$4,533,138	\$7,558,320
Feb-93	102.288	5.3	143.100	60.1015	\$4,533,138	\$7,542,474
Mar-93	102.595	5.0	143.300	60.1855	\$4,533,138	\$7,531,947
Apr-93	102.866	4.9	143.800	60.3955	\$4,533,138	\$7,505,758
May-93	103.326	4.8	144.200	60.5635	\$4,533,138	\$7,484,938
Jun-93	103.190	4.6	144.300	60.6055	\$4,533,138	\$7,479,751
Jul-93	103.387	4.5	144.500	60.6895	\$4,533,138	\$7,469,398
Aug-93	103.384	4.5	144.800	60.8155	\$4,533,138	\$7,453,923
Sep-93	103.816	4.5	145.000	60.8995	\$4,533,138	\$7,443,642
Oct-93	104.120	4.6	145.600	61.1515	\$4,533,138	\$7,412,968
Nov-93	104.074	4.4	146.000	61.3195	\$4,533,138	\$7,392,658
Dec-93	104.045	4.5	146.300	61.4455	\$4,533,138	\$7,377,499
Jan-94	103.331	4.6	146.300	61.4455	\$4,777,676	\$7,775,474
Feb-94	104.290	4.8	146.700	61.6135	\$4,777,676	\$7,754,273
Mar-94	104.148	4.6	147.100	61.7815	\$4,777,676	\$7,733,188
Apr-94	104.839	4.6	147.200	61.8235	\$4,777,676	\$7,727,934
May-94	105.127	4.4	147.500	61.9495	\$4,777,676	\$7,712,216
Jun-94	105.359	4.4	147.900	62.1175	\$4,777,676	\$7,691,358
Jul-94	106.214	4.4	148.400	62.3275	\$4,777,676	\$7,665,444
Aug-94	106.516	4.5	149.000	62.5794	\$4,777,676	\$7,634,577
Sep-94	106.115	4.1	149.300	62.7054	\$4,777,676	\$7,619,236
Oct-94	106.798	4.1	149.400	62.7474	\$4,777,676	\$7,614,136
Nov-94	107.208	4.0	149.800	62.9154	\$4,777,676	\$7,593,805
Dec-94	107.434	3.8	150.100	63.0414	\$4,777,676	\$7,578,627
Jan-95	107.872	4.0	150.500	63.2094	\$4,986,532	\$7,888,903
Feb-95	108.124	3.9	150.900	63.3774	\$4,986,532	\$7,867,992
Mar-95	108.249	4.5	151.200	63.5034	\$4,986,532	\$7,852,381
Apr-95	108.878	4.0	151.800	63.7554	\$4,986,532	\$7,821,344
May-95	109.363	3.9	152.100	63.8814	\$4,986,532	\$7,805,917
Jun-95	109.046	4.0	152.400	64.0074	\$4,986,532	\$7,790,551
Jul-95	109.576	4.0	152.600	64.0914	\$4,986,532	\$7,780,341
Aug-95	109.660	4.3	152.900	64.2174	\$4,986,532	\$7,765,075
Sep-95	109.992	4.2	153.100	64.3014	\$4,986,532	\$7,754,931
Oct-95	110.120	4.2	153.500	64.4694	\$4,986,532	\$7,734,723
Nov-95	110.049	4.2	153.700	64.5534	\$4,986,532	\$7,724,658
Dec-95	110.162	4.4	153.900	64.6374	\$4,986,532	\$7,714,620
Jan-96	110.022	4.5	154.700	64.9734	\$5,297,462	\$8,153,275

Feb-96	110.274	4.4	155.000	65.0994	\$5,297,462	\$8,137,494
Mar-96	110.610	4.2	155.500	65.3094	\$5,297,462	\$8,111,328
Apr-96	110.225	4.3	156.100	65.5614	\$5,297,462	\$8,080,151
May-96	110.411	4.3	156.400	65.6874	\$5,297,462	\$8,064,652
Jun-96	110.540	4.0	156.700	65.8134	\$5,297,462	\$8,049,212
Jul-96	110.246	4.0	157.000	65.9394	\$5,297,462	\$8,033,832
Aug-96	110.504	3.8	157.200	66.0234	\$5,297,462	\$8,023,611
Sep-96	110.897	3.9	157.700	66.2334	\$5,297,462	\$7,998,171
Oct-96	110.898	3.9	158.200	66.4434	\$5,297,462	\$7,972,892
Nov-96	111.927	4.0	158.700	66.6534	\$5,297,462	\$7,947,773
Dec-96	111.683	4.0	159.100	66.8214	\$5,297,462	\$7,927,791
Jan-97	112.185	3.9	159.400	66.9474	\$5,511,225	\$8,232,170
Feb-97	112.723	4.0	159.700	67.0734	\$5,511,225	\$8,216,706
Mar-97	113.282	4.1	159.800	67.1154	\$5,511,225	\$8,211,564
Apr-97	113.272	4.0	159.900	67.1574	\$5,511,225	\$8,206,429
May-97	113.244	4.1	159.900	67.1574	\$5,511,225	\$8,206,429
Jun-97	114.222	4.1	160.200	67.2834	\$5,511,225	\$8,191,061
Jul-97	114.639	4.0	160.400	67.3674	\$5,511,225	\$8,180,848
Aug-97	114.582	3.8	160.800	67.5354	\$5,511,225	\$8,160,497
Sep-97	114.930	4.0	161.200	67.7034	\$5,511,225	\$8,140,248
Oct-97	115.336	3.9	161.500	67.8294	\$5,511,225	\$8,125,127
Nov-97	115.229	3.9	161.700	67.9134	\$5,511,225	\$8,115,077
Dec-97	115.461	3.9	161.800	67.9554	\$5,511,225	\$8,110,062
Jan-98	115.633	3.7	162.000	68.0394	\$5,774,300	\$8,486,700
Feb-98	116.370	3.6	162.000	68.0394	\$5,774,300	\$8,486,700
Mar-98	115.830	3.6	162.000	68.0394	\$5,774,300	\$8,486,700
Apr-98	115.859	3.5	162.200	68.1234	\$5,774,300	\$8,476,236
May-98	116.127	3.6	162.600	68.2914	\$5,774,300	\$8,455,384
Jun-98	116.104	3.8	162.800	68.3754	\$5,774,300	\$8,444,997
Jul-98	116.193	3.7	163.200	68.5434	\$5,774,300	\$8,424,298
Aug-98	115.846	3.8	163.400	68.6274	\$5,774,300	\$8,413,987
Sep-98	116.102	3.4	163.500	68.6694	\$5,774,300	\$8,408,841
Oct-98	116.224	3.3	163.900	68.8374	\$5,774,300	\$8,388,319
Nov-98	116.156	3.1	164.100	68.9214	\$5,774,300	\$8,378,095
Dec-98	117.040	2.9	164.400	69.0474	\$5,774,300	\$8,362,807
Jan-99	116.955	3.0	164.700	69.1734	\$5,941,737	\$8,589,628
Feb-99	116.564	3.0	164.700	69.1734	\$5,941,737	\$8,589,628
Mar-99	117.074	2.7	164.800	69.2154	\$5,941,737	\$8,584,416
Apr-99	117.329	3.1	165.900	69.6774	\$5,941,737	\$8,527,497
May-99	117.282	3.0	166.000	69.7194	\$5,941,737	\$8,522,360

Jun-99	117.815	3.1	166.000	69.7194	\$5,941,737	\$8,522,360
Jul-99	119.286	3.2	166.700	70.0134	\$5,941,737	\$8,486,573
Aug-99	119.433	3.0	167.100	70.1814	\$5,941,737	\$8,466,258
Sep-99	119.637	3.1	167.800	70.4754	\$5,941,737	\$8,430,940
Oct-99	120.171	3.1	168.100	70.6014	\$5,941,737	\$8,415,894
Nov-99	120.649	3.0	168.400	70.7274	\$5,941,737	\$8,400,901
Dec-99	120.844	3.0	168.800	70.8954	\$5,941,737	\$8,380,994
Jan-00	120.149	3.8	169.300	71.1054	\$6,339,817	\$8,916,087
Feb-00	120.088	3.8	170.000	71.3994	\$6,339,817	\$8,879,374
Mar-00	120.241	3.7	171.000	71.8194	\$6,339,817	\$8,827,447
Apr-00	120.804	3.4	170.900	71.7774	\$6,339,817	\$8,832,613
May-00	121.139	3.6	171.200	71.9034	\$6,339,817	\$8,817,135
Jun-00	121.449	3.4	172.200	72.3234	\$6,339,817	\$8,765,932
Jul-00	120.907	3.5	172.700	72.5334	\$6,339,817	\$8,740,553
Aug-00	120.605	3.6	172.700	72.5334	\$6,339,817	\$8,740,553
Sep-00	121.516	3.6	173.600	72.9114	\$6,339,817	\$8,695,239
Oct-00	121.998	3.6	173.900	73.0374	\$6,339,817	\$8,680,239
Nov-00	122.573	3.4	174.200	73.1634	\$6,339,817	\$8,665,290
Dec-00	122.154	3.3	174.600	73.3314	\$6,339,817	\$8,645,438
Jan-01	122.980	3.4	175.600	73.7514	\$6,264,136	\$8,493,588
Feb-01	123.250	3.3	176.000	73.9193	\$6,264,136	\$8,474,285
Mar-01	123.334	3.5	176.100	73.9613	\$6,264,136	\$8,469,472
Apr-01	124.001	3.5	176.400	74.0873	\$6,264,136	\$8,455,068
May-01	123.914	3.5	177.300	74.4653	\$6,264,136	\$8,412,149
Jun-01	124.170	3.6	177.700	74.6333	\$6,264,136	\$8,393,214
Jul-01	123.570	3.6	177.400	74.5073	\$6,264,136	\$8,407,407
Aug-01	123.922	3.8	177.400	74.5073	\$6,264,136	\$8,407,407
Sep-01	123.309	3.9	178.100	74.8013	\$6,264,136	\$8,374,363
Oct-01	122.989	4.0	177.600	74.5913	\$6,264,136	\$8,397,940
Nov-01	122.752	4.1	177.500	74.5493	\$6,264,136	\$8,402,671
Dec-01	123.161	4.2	177.400	74.5073	\$6,264,136	\$8,407,407
Jan-02	122.950	4.1	177.700	74.6333	\$6,536,679	\$8,758,390
Feb-02	122.701	4.0	178.000	74.7593	\$6,536,679	\$8,743,628
Mar-02	122.593	4.2	178.500	74.9693	\$6,536,679	\$8,719,136
Apr-02	121.907	4.4	179.300	75.3053	\$6,536,679	\$8,680,233
May-02	121.925	4.4	179.500	75.3893	\$6,536,679	\$8,670,562
Jun-02	121.667	4.5	179.600	75.4313	\$6,536,679	\$8,665,734
Jul-02	122.212	4.5	180.000	75.5993	\$6,536,679	\$8,646,477
Aug-02	122.104	4.4	180.500	75.8093	\$6,536,679	\$8,622,525
Sep-02	121.558	4.5	180.800	75.9353	\$6,536,679	\$8,608,218
Oct-02	121.470	4.5	181.200	76.1033	\$6,536,679	\$8,589,215

Nov-02	122.009	4.7	181.500	76.2293	\$6,536,679	\$8,575,018
Dec-02	121.775	4.7	181.800	76.3553	\$6,536,679	\$8,560,868
Jan-03	122.158	4.7	182.600	76.6913	\$6,945,273	\$9,056,139
Feb-03	121.937	4.8	183.600	77.1113	\$6,945,273	\$9,006,814
Mar-03	122.314	4.5	183.900	77.2373	\$6,945,273	\$8,992,121
Apr-03	121.867	4.8	183.200	76.9433	\$6,945,273	\$9,026,479
May-03	121.408	5.0	182.900	76.8173	\$6,945,273	\$9,041,285
Jun-03	121.174	5.0	183.100	76.9013	\$6,945,273	\$9,031,409
Jul-03	120.491	5.0	183.700	77.1533	\$6,945,273	\$9,001,911
Aug-03	120.883	5.1	184.500	77.4893	\$6,945,273	\$8,962,878
Sep-03	121.460	5.1	185.100	77.7413	\$6,945,273	\$8,933,825
Oct-03	121.331	4.9	184.900	77.6573	\$6,945,273	\$8,943,488
Nov-03	121.510	4.8	185.000	77.6993	\$6,945,273	\$8,938,654
Dec-03	121.813	4.7	185.500	77.9093	\$6,945,273	\$8,914,561
Jan-04	121.429	4.7	186.300	78.2453	\$7,188,257	\$9,186,821
Feb-04	121.621	4.6	186.700	78.4133	\$7,188,257	\$9,167,139
Mar-04	121.810	4.6	187.100	78.5813	\$7,188,257	\$9,147,540
Apr-04	122.879	4.4	187.400	78.7073	\$7,188,257	\$9,132,897
May-04	123.677	4.4	188.200	79.0433	\$7,188,257	\$9,094,075
Jun-04	123.624	4.4	188.900	79.3373	\$7,188,257	\$9,060,375
Jul-04	123.359	4.4	189.100	79.4213	\$7,188,257	\$9,050,792
Aug-04	123.404	4.4	189.200	79.4633	\$7,188,257	\$9,046,009
Sep-04	123.618	4.4	189.800	79.7153	\$7,188,257	\$9,017,412
Oct-04	122.424	4.6	190.800	80.1353	\$7,188,257	\$8,970,151
Nov-04	122.900	4.6	191.700	80.5133	\$7,188,257	\$8,928,038
Dec-04	123.162	4.7	191.700	80.5133	\$7,188,257	\$8,928,038
Jan-05	123.998	4.4	191.600	80.4713	\$7,624,985	\$9,475,410
Feb-05	124.417	4.5	192.400	80.8073	\$7,624,985	\$9,436,011
Mar-05	124.605	4.3	193.100	81.1013	\$7,624,985	\$9,401,805
Apr-05	124.052	4.4	193.700	81.3533	\$7,624,985	\$9,372,682
May-05	124.351	4.2	193.600	81.3113	\$7,624,985	\$9,377,524
Jun-05	124.954	4.1	193.700	81.3533	\$7,624,985	\$9,372,682
Jul-05	124.655	4.0	194.900	81.8573	\$7,624,985	\$9,314,975
Aug-05	124.715	4.1	196.100	82.3613	\$7,624,985	\$9,257,973
Sep-05	125.402	3.9	198.800	83.4953	\$7,624,985	\$9,132,236
Oct-05	124.706	3.9	199.100	83.6213	\$7,624,985	\$9,118,476
Nov-05	124.700	4.0	198.100	83.2013	\$7,624,985	\$9,164,506
Dec-05	125.260	4.1	198.100	83.2013	\$7,624,985	\$9,164,506
Jan-06	125.140	3.9	199.300	83.7053	\$8,026,285	\$9,588,746
Feb-06	125.530	4.0	199.400	83.7473	\$8,026,285	\$9,583,937
Mar-06	125.823	4.5	199.700	83.8733	\$8,026,285	\$9,569,540

Apr-06	125.800	4.3	200.700	84.2933	\$8,026,285	\$9,521,859
May-06	125.860	4.1	201.300	84.5453	\$8,026,285	\$9,493,478
Jun-06	125.971	4.1	201.800	84.7553	\$8,026,285	\$9,469,956
Jul-06	125.807	4.0	202.900	85.2173	\$8,026,285	\$9,418,615
Aug-06	126.577	4.0	203.800	85.5952	\$8,026,285	\$9,377,022
Sep-06	127.200	3.9	202.800	85.1753	\$8,026,285	\$9,423,260
Oct-06	126.547	3.8	201.900	84.7973	\$8,026,285	\$9,465,265
Nov-06	127.153	3.7	202.000	84.8393	\$8,026,285	\$9,460,579
Dec-06	127.214	3.4	203.100	85.3012	\$8,026,285	\$9,409,341
Jan-07	126.501	3.7	203.437	85.4428	\$8,551,715	\$10,008,703
Feb-07	126.602	3.7	204.226	85.7742	\$8,551,715	\$9,970,036
Mar-07	126.222	3.9	205.288	86.2202	\$8,551,715	\$9,918,459
Apr-07	126.020	3.6	205.904	86.4789	\$8,551,715	\$9,888,786
May-07	126.100	3.3	206.755	86.8363	\$8,551,715	\$9,848,084
Jun-07	126.601	3.6	207.234	87.0375	\$8,551,715	\$9,825,321
Jul-07	127.196	3.6	207.603	87.1925	\$8,551,715	\$9,807,857
Aug-07	127.468	3.4	207.667	87.2194	\$8,551,715	\$9,804,834
Sep-07	127.236	3.6	208.547	87.5890	\$8,551,715	\$9,763,461
Oct-07	127.181	3.6	209.190	87.8590	\$8,551,715	\$9,733,451
Nov-07	127.454	3.6	210.834	88.5495	\$8,551,715	\$9,657,553
Dec-07	127.489	3.7	211.445	88.8061	\$8,551,715	\$9,629,646
Jan-08	128.602	3.5	212.174	89.1123	\$9,135,499	\$10,251,671
Feb-08	128.896	3.3	212.687	89.3278	\$9,135,499	\$10,226,944
Mar-08	128.775	3.5	213.448	89.6474	\$9,135,499	\$10,190,482
Apr-08	129.433	3.4	213.942	89.8548	\$9,135,499	\$10,166,952
May-08	129.566	3.6	215.208	90.3866	\$9,135,499	\$10,107,143
Jun-08	129.708	3.7	217.463	91.3337	\$9,135,499	\$10,002,336
Jul-08	130.329	3.8	219.016	91.9859	\$9,135,499	\$9,931,411
Aug-08	130.095	3.9	218.690	91.8490	\$9,135,499	\$9,946,216
Sep-08	130.107	3.9	218.877	91.9275	\$9,135,499	\$9,937,718
Oct-08	130.006	4.0	216.995	91.1371	\$9,135,499	\$10,023,908
Nov-08	129.576	4.1	213.153	89.5235	\$9,135,499	\$10,204,585
Dec-08	130.654	4.1	211.398	88.7864	\$9,135,499	\$10,289,302
Jan-09	129.678	4.5	211.933	89.0111	\$9,147,189	\$10,276,461
Feb-09	129.086	4.7	212.705	89.3353	\$9,147,189	\$10,239,164
Mar-09	128.678	4.7	212.495	89.2471	\$9,147,189	\$10,249,283
Apr-09	128.182	4.7	212.709	89.3370	\$9,147,189	\$10,238,971
May-09	127.921	5.2	213.022	89.4685	\$9,147,189	\$10,223,927
Jun-09	128.194	5.6	214.790	90.2110	\$9,147,189	\$10,139,771
Jul-09	128.395	5.7	214.726	90.1841	\$9,147,189	\$10,142,793
Aug-09	127.774	5.8	215.445	90.4861	\$9,147,189	\$10,108,943

Sep-09	127.957	5.9	215.861	90.6608	\$9,147,189	\$10,089,462
Oct-09	127.525	5.9	216.509	90.9330	\$9,147,189	\$10,059,265
Nov-09	127.657	6.0	217.234	91.2375	\$9,147,189	\$10,025,693
Dec-09	127.208	6.1	217.347	91.2849	\$9,147,189	\$10,020,480
Jan-10	126.971	6.4	217.488	91.3442	\$9,622,215	\$10,534,024
Feb-10	126.988	6.5	217.281	91.2572	\$9,622,215	\$10,544,059
Mar-10	127.344	6.5	217.353	91.2875	\$9,622,215	\$10,540,566
Apr-10	127.840	6.7	217.403	91.3085	\$9,622,215	\$10,538,142
May-10	128.296	6.2	217.290	91.2610	\$9,622,215	\$10,543,623
Jun-10	128.404	5.9	217.199	91.2228	\$9,622,215	\$10,548,040
Jul-10	127.791	6.0	217.605	91.3933	\$9,622,215	\$10,528,360
Aug-10	127.641	6.2	217.923	91.5269	\$9,622,215	\$10,512,996
Sep-10	127.885	6.1	218.275	91.6747	\$9,622,215	\$10,496,043
Oct-10	129.118	6.3	219.035	91.9939	\$9,622,215	\$10,459,624
Nov-10	129.084	6.7	219.590	92.2270	\$9,622,215	\$10,433,188
Dec-10	129.973	6.4	220.472	92.5974	\$9,622,215	\$10,391,450
Jan-11	130.592	6.1	221.187	92.8977	\$10,073,563	\$10,843,714
Feb-11	130.107	6.1	221.898	93.1963	\$10,073,563	\$10,808,968
Mar-11	130.816	5.9	223.046	93.6785	\$10,073,563	\$10,753,336
Apr-11	130.543	6.3	224.093	94.1182	\$10,073,563	\$10,703,094
May-11	130.193	6.1	224.806	94.4177	\$10,073,563	\$10,669,148
Jun-11	130.247	6.0	224.806	94.4177	\$10,073,563	\$10,669,148
Jul-11	129.765	6.1	225.395	94.6651	\$10,073,563	\$10,641,268
Aug-11	130.047	6.1	226.106	94.9637	\$10,073,563	\$10,607,806
Sep-11	129.852	6.2	226.597	95.1699	\$10,073,563	\$10,584,820
Oct-11	129.771	6.1	226.750	95.2342	\$10,073,563	\$10,577,678
Nov-11	130.256	5.9	227.169	95.4101	\$10,073,563	\$10,558,168
Dec-11	130.394	5.8	227.223	95.4328	\$10,073,563	\$10,555,659
Jan-12	129.970	5.7	227.860	95.7004	\$10,747,714	\$11,230,589
Feb-12	130.271	5.7	228.377	95.9175	\$10,747,714	\$11,205,165
Mar-12	129.983	5.8	228.894	96.1346	\$10,747,714	\$11,179,856
Apr-12	130.662	5.6	229.286	96.2993	\$10,747,714	\$11,160,743
May-12	130.990	5.5	228.722	96.0624	\$10,747,714	\$11,188,264
Jun-12	131.600	5.4	228.506	95.9717	\$10,747,714	\$11,198,840
Jul-12	131.194	5.4	228.475	95.9587	\$10,747,714	\$11,200,359
Aug-12	131.601	5.3	229.844	96.5336	\$10,747,714	\$11,133,647
Sep-12	131.620	5.0	230.987	97.0137	\$10,747,714	\$11,078,554
Oct-12	131.932	5.1	231.655	97.2942	\$10,747,714	\$11,046,608
Nov-12	132.537	5.0	231.278	97.1359	\$10,747,714	\$11,064,615
Dec-12	132.706	5.2	231.272	97.1334	\$10,747,714	\$11,064,902
Jan-13	132.666	5.4	231.641	97.2884	\$11,034,893	\$11,342,459

Feb-13	133.546	5.2	233.005	97.8612	\$11,034,893	\$11,276,061
Mar-13	133.585	5.3	232.313	97.5706	\$11,034,893	\$11,309,649
Apr-13	134.195	5.1	231.856	97.3787	\$11,034,893	\$11,331,941
May-13	134.592	5.1	231.895	97.3950	\$11,034,893	\$11,330,036
Jun-13	134.535	5.0	232.357	97.5891	\$11,034,893	\$11,307,508
Jul-13	135.294	4.8	232.749	97.7537	\$11,034,893	\$11,288,464
Aug-13	135.725	4.7	233.249	97.9637	\$11,034,893	\$11,264,265
Sep-13	135.579	4.7	233.642	98.1288	\$11,034,893	\$11,245,318
Oct-13	135.404	4.7	233.799	98.1947	\$11,034,893	\$11,237,767
Nov-13	135.828	4.6	234.21	98.3673	\$11,034,893	\$11,218,046
Dec-13	135.344	4.4	234.847	98.6349	\$11,034,893	\$11,187,618
Jan-14	135.689	4.3	235.436	98.8822	\$11,441,626	\$11,570,960
Feb-14	136.209	4.4	235.621	98.9599	\$11,441,626	\$11,561,875
Mar-14	136.462	4.2	235.897	99.0759	\$11,441,626	\$11,548,348
Apr-14	136.560	4.0	236.495	99.3270	\$11,441,626	\$11,519,147
May-14	136.872	4.0	236.803	99.4564	\$11,441,626	\$11,504,164
Jun-14	136.972	3.9	237.016	99.5458	\$11,441,626	\$11,493,826
Jul-14	137.243	4.0	237.259	99.6479	\$11,441,626	\$11,482,054
Aug-14	137.256	4.0	237.163	99.6076	\$11,441,626	\$11,486,702
Sep-14	137.142	3.8	237.51	99.7533	\$11,441,626	\$11,469,920
Oct-14	138.044	3.7	237.651	99.8125	\$11,441,626	\$11,463,115
Nov-14	137.709	3.7	237.261	99.6487	\$11,441,626	\$11,481,957
Dec-14	138.376	3.4	236.464	99.3140	\$11,441,626	\$11,520,657
Jan-15	139.003	3.7	234.954	98.6798		
Feb-15	139.102	3.5	235.415	98.8734		
Mar-15	139.442	3.4	235.859	99.0599		
Apr-15	139.759	3.4	236.197	99.2019		
May-15	139.452	3.5	236.876	99.4870		
Jun-15	139.800	3.5	237.423	99.7168		
Jul-15	140.853	3.4	237.734	99.8474		
Aug-15	140.742	3.4	237.703	99.8344		
Sep-15	141.129	3.4	237.489	99.7445		
Oct-15	141.007	3.5	237.949	99.9377		
Nov-15	141.164	3.5	238.302	100.0860		
Dec-15	141.386	3.4	238.041	99.9763		
Jan-16	141.270	3.3	238.107	100.0041		
Feb-16	141.436	3.3	237.707	99.8361		
Mar-16	141.307	3.3	237.920	99.9255		
Apr-16	142.017	3.6	238.890	100.3329		
May-16	141.791	3.3	239.410	100.5513		
Jun-16	141.833	3.7	239.927	100.7685		
Jul-16	141.417	4.2	239.828	100.7269		

Table 7: 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	53.7735	\$722,623,502	\$1,343,827,615	\$457,397,967	\$850,600,648
Q2-90	129.300	54.3055	\$775,774,395	\$1,428,536,851	\$461,898,005	\$850,554,395
Q3-90	131.533	55.2435	\$727,100,162	\$1,316,172,906	\$468,590,811	\$848,227,743
Q4-90	133.767	56.1815	\$833,590,748	\$1,483,745,832	\$468,329,615	\$833,601,041
Q1-91	134.767	56.6015	\$850,499,175	\$1,502,608,847	\$477,851,548	\$844,238,283
Q2-91	135.567	56.9375	\$807,325,699	\$1,417,915,634	\$481,859,213	\$846,295,011
Q3-91	136.600	57.3715	\$824,222,981	\$1,436,641,976	\$486,354,133	\$847,727,834
Q4-91	137.733	57.8475	\$776,673,136	\$1,342,621,993	\$478,474,983	\$827,131,782
Q1-92	138.667	58.2395	\$823,925,093	\$1,414,718,996	\$498,312,769	\$855,626,982
Q2-92	139.733	58.6875	\$823,377,936	\$1,402,987,291	\$496,200,133	\$845,495,671
Q3-92	140.800	59.1355	\$830,995,686	\$1,405,240,460	\$501,146,414	\$847,454,722
Q4-92	142.033	59.6535	\$792,327,938	\$1,328,217,572	\$519,029,154	\$870,073,627
Q1-93	143.067	60.0875	\$856,606,231	\$1,425,598,738	\$505,763,238	\$841,711,638
Q2-93	144.100	60.5215	\$922,785,589	\$1,524,724,414	\$526,886,955	\$870,578,618
Q3-93	144.767	60.8015	\$978,050,121	\$1,608,596,308	\$534,046,957	\$878,345,542
Q4-93	145.967	61.3055	\$1,067,259,310	\$1,740,887,845	\$553,949,094	\$903,588,506
Q1-94	146.700	61.6135	\$983,059,467	\$1,595,527,182	\$538,838,004	\$874,545,956
Q2-94	147.533	61.9635	\$1,007,761,483	\$1,626,380,401	\$549,102,639	\$886,171,763
Q3-94	148.900	62.5374	\$1,028,769,618	\$1,645,045,685	\$572,412,705	\$915,311,878
Q4-94	149.767	62.9014	\$1,174,097,467	\$1,866,566,721	\$572,640,708	\$910,377,646
Q1-95	150.867	63.3634	\$995,305,216	\$1,570,787,789	\$581,444,523	\$917,634,050
Q2-95	152.100	63.8814	\$1,067,769,056	\$1,671,485,633	\$587,055,300	\$918,976,341
Q3-95	152.867	64.2034	\$1,058,838,482	\$1,649,192,885	\$587,247,528	\$914,666,836
Q4-95	153.700	64.5534	\$1,050,653,590	\$1,627,572,011	\$598,844,501	\$927,672,601
Q1-96	155.067	65.1274	\$1,025,426,818	\$1,574,493,063	\$620,574,361	\$952,861,783
Q2-96	156.400	65.6874	\$1,036,844,063	\$1,578,451,448	\$615,230,350	\$936,602,978
Q3-96	157.300	66.0654	\$1,045,270,304	\$1,582,174,647	\$621,764,332	\$941,134,326
Q4-96	158.667	66.6394	\$1,037,222,360	\$1,556,469,820	\$633,736,935	\$950,994,165
Q1-97	159.633	67.0454	\$1,241,455,551	\$1,851,663,747	\$640,908,342	\$955,931,721
Q2-97	160.000	67.1994	\$1,124,351,413	\$1,673,156,707	\$652,170,722	\$970,500,686
Q3-97	160.800	67.5354	\$1,187,297,429	\$1,758,037,014	\$663,905,301	\$983,047,773
Q4-97	161.667	67.8994	\$1,178,888,223	\$1,736,227,684	\$683,763,481	\$1,007,024,298
Q1-98	162.000	68.0394	\$1,183,048,116	\$1,738,769,146	\$680,683,151	\$1,000,424,957
Q2-98	162.533	68.2634	\$1,124,473,143	\$1,647,256,297	\$713,354,716	\$1,045,003,213

Q3-98	163.367	68.6134	\$1,095,725,870	\$1,596,956,179	\$703,709,116	\$1,025,614,756
Q4-98	164.133	68.9354	\$1,162,585,651	\$1,686,485,844	\$720,499,256	\$1,045,180,452
Q1-99	164.733	69.1874	\$1,133,007,074	\$1,637,591,843	\$684,400,453	\$989,198,237
Q2-99	165.967	69.7054	\$1,127,191,442	\$1,617,079,392	\$710,274,516	\$1,018,966,469
Q3-99	167.200	70.2234	\$1,148,343,605	\$1,635,272,429	\$721,604,520	\$1,027,584,401
Q4-99	168.433	70.7414	\$1,115,415,678	\$1,576,751,426	\$746,239,046	\$1,054,883,397
Q1-00	170.100	71.4414	\$1,232,797,520	\$1,725,607,302	\$773,016,450	\$1,082,029,131
Q2-00	171.433	72.0014	\$1,230,504,582	\$1,709,001,710	\$773,146,681	\$1,073,794,456
Q3-00	173.000	72.6594	\$1,104,443,036	\$1,520,028,564	\$777,360,496	\$1,069,869,717
Q4-00	174.233	73.1774	\$1,172,457,900	\$1,602,214,077	\$782,951,647	\$1,069,937,054
Q1-01	175.900	73.8773	\$1,039,161,379	\$1,406,603,487	\$800,172,319	\$1,083,109,126
Q2-01	177.133	74.3953	\$1,099,468,552	\$1,477,872,771	\$797,190,164	\$1,071,559,196
Q3-01	177.633	74.6053	\$1,084,857,142	\$1,454,127,936	\$809,655,138	\$1,085,250,869
Q4-01	177.500	74.5493	\$1,130,524,174	\$1,516,477,696	\$804,326,955	\$1,078,918,890
Q1-02	178.067	74.7873	\$851,791,802	\$1,138,951,834	\$813,282,151	\$1,087,459,630
Q2-02	179.467	75.3753	\$872,534,737	\$1,157,586,520	\$824,986,079	\$1,094,504,004
Q3-02	180.433	75.7813	\$887,221,562	\$1,170,765,314	\$839,213,657	\$1,107,414,745
Q4-02	181.500	76.2293	\$828,624,707	\$1,087,015,609	\$830,567,980	\$1,089,564,855
Q1-03	183.367	77.0133	\$876,258,001	\$1,137,800,545	\$842,121,245	\$1,093,474,765
Q2-03	183.067	76.8873	\$872,725,524	\$1,135,070,758	\$838,564,972	\$1,090,641,389
Q3-03	184.433	77.4613	\$872,070,306	\$1,125,813,922	\$843,807,838	\$1,089,328,011
Q4-03	185.133	77.7553	\$882,763,912	\$1,135,310,047	\$838,658,096	\$1,078,586,188
Q1-04	186.700	78.4133	\$934,700,575	\$1,192,017,752	\$857,671,307	\$1,093,782,813
Q2-04	188.167	79.0293	\$942,696,205	\$1,192,843,858	\$858,683,965	\$1,086,538,683
Q3-04	189.367	79.5333	\$948,991,993	\$1,193,200,825	\$877,192,784	\$1,102,925,168
Q4-04	191.400	80.3873	\$942,882,016	\$1,172,924,209	\$898,774,417	\$1,118,055,340
Q1-05	192.367	80.7933	\$945,361,364	\$1,170,098,872	\$889,668,048	\$1,101,165,776
Q2-05	193.667	81.3393	\$956,626,570	\$1,176,094,158	\$911,409,817	\$1,120,503,857
Q3-05	196.600	82.5713	\$988,814,122	\$1,197,528,004	\$946,547,756	\$1,146,340,267
Q4-05	198.433	83.3413	\$1,012,685,588	\$1,215,107,028	\$935,932,377	\$1,123,011,943
Q1-06	199.467	83.7753	\$1,015,335,193	\$1,211,974,943	\$996,627,413	\$1,189,644,031
Q2-06	201.267	84.5313	\$1,044,340,856	\$1,235,449,351	\$989,333,112	\$1,170,375,500
Q3-06	203.167	85.3292	\$1,014,369,581	\$1,188,771,250	\$974,502,639	\$1,142,049,941
Q4-06	202.333	84.9793	\$1,048,528,443	\$1,233,864,050	\$987,119,103	\$1,161,600,129
Q1-07	204.317	85.8124	\$1,076,253,846	\$1,254,194,074	\$992,303,578	\$1,156,364,061
Q2-07	206.631	86.7843	\$1,085,298,968	\$1,250,571,261	\$1,010,326,848	\$1,164,182,181
Q3-07	207.939	87.3336	\$1,079,314,939	\$1,235,852,865	\$1,017,545,576	\$1,165,124,812

Q4-07	210.490	88.4049	\$1,078,306,432	\$1,219,736,294	\$1,036,109,741	\$1,172,005,117
Q1-08	212.770	89.3625	\$1,145,600,950	\$1,281,970,948	\$1,064,476,569	\$1,191,189,687
Q2-08	215.538	90.5250	\$1,140,085,961	\$1,259,415,263	\$1,068,130,870	\$1,179,928,853
Q3-08	218.861	91.9208	\$1,110,133,939	\$1,207,706,857	\$1,084,222,512	\$1,179,517,999
Q4-08	213.849	89.8156	\$1,055,423,927	\$1,175,100,254	\$1,081,795,656	\$1,204,462,319
Q1-09	212.378	89.1978	\$1,006,086,111	\$1,127,926,603	\$1,080,532,736	\$1,211,388,970
Q2-09	213.507	89.6722	\$1,012,854,593	\$1,129,508,529	\$1,071,214,748	\$1,194,590,224
Q3-09	215.344	90.4437	\$1,058,193,032	\$1,170,002,132	\$1,069,149,815	\$1,182,116,612
Q4-09	217.030	91.1518	\$1,065,491,147	\$1,168,919,508	\$1,092,659,854	\$1,198,725,510
Q1-10	217.374	91.2963	\$1,071,823,010	\$1,174,005,173	\$1,069,258,185	\$1,171,195,831
Q2-10	217.297	91.2641	\$1,101,007,518	\$1,206,397,474	\$1,113,261,996	\$1,219,824,967
Q3-10	217.934	91.5316	\$1,060,495,174	\$1,158,610,803	\$1,096,155,504	\$1,197,570,380
Q4-10	219.699	92.2728	\$1,124,777,987	\$1,218,970,679	\$1,150,835,849	\$1,247,210,714
Q1-11	222.044	93.2575	\$1,141,461,245	\$1,223,988,428	\$1,116,630,302	\$1,197,362,218
Q2-11	224.568	94.3179	\$1,188,152,936	\$1,259,732,579	\$1,156,929,008	\$1,226,627,582
Q3-11	226.033	94.9329	\$1,173,397,184	\$1,236,028,157	\$1,169,495,587	\$1,231,918,310
Q4-11	227.047	95.3590	\$1,188,492,251	\$1,246,334,107	\$1,115,410,358	\$1,169,695,446
Q1-12	228.377	95.9175	\$1,260,182,045	\$1,313,818,749	\$1,184,492,170	\$1,234,907,311
Q2-12	228.838	96.1111	\$1,290,202,989	\$1,342,407,691	\$1,175,467,522	\$1,223,029,752
Q3-12	229.769	96.5020	\$1,288,976,721	\$1,335,699,616	\$1,202,813,131	\$1,246,412,764
Q4-12	231.402	97.1878	\$1,288,265,347	\$1,325,541,636	\$1,226,365,766	\$1,261,850,974
Q1-13	232.320	97.5734	\$1,304,032,384	\$1,336,462,976	\$1,232,971,620	\$1,263,634,969
Q2-13	232.036	97.4543	\$1,312,957,914	\$1,347,255,503	\$1,238,736,728	\$1,271,095,484
Q3-13	233.213	97.9487	\$1,290,610,204	\$1,317,638,419	\$1,264,233,463	\$1,290,709,291
Q4-13	234.285	98.3990	\$1,567,792,590	\$1,593,301,764	\$1,260,179,703	\$1,280,683,782
Q1-14	235.651	98.9727	\$1,322,070,918	\$1,335,793,673	\$1,314,551,785	\$1,328,196,493
Q2-14	236.771	99.4431	\$1,393,287,969	\$1,401,090,855	\$1,306,902,986	\$1,314,222,087
Q3-14	237.311	99.6696	\$1,471,917,165	\$1,476,796,458	\$1,336,377,997	\$1,340,807,988
Q4-14	237.125	99.5918	\$1,450,191,542	\$1,456,136,019	\$1,334,488,572	\$1,339,958,771
Q1-15	235.409	98.8710	\$1,408,840,694	\$1,424,927,413	\$1,358,764,002	\$1,374,278,925
Q2-15	236.832	99.4686	\$1,393,229,406	\$1,400,673,077	\$1,374,718,538	\$1,382,063,311
Q3-15	237.642	99.8088	\$1,330,952,080	\$1,333,502,247	\$1,391,287,052	\$1,393,952,824
Q4-15	238.097	100.0000	\$1,312,994,765	\$1,312,994,765	\$1,427,270,033	\$1,427,270,033

Table 8: Lubbock Business Cycle Index

Date	Business Cycle Index
Oct-90	100.0000
Nov-90	100.1699
Dec-90	100.2238
Jan-91	100.0971
Feb-91	99.8099
Mar-91	99.2906
Apr-91	98.9621
May-91	98.8919
Jun-91	98.7303
Jul-91	98.6568
Aug-91	98.4598
Sep-91	98.0916
Oct-91	98.0835
Nov-91	98.1691
Dec-91	98.4347
Jan-92	99.0479
Feb-92	99.2684
Mar-92	99.4105
Apr-92	99.6984
May-92	99.8177
Jun-92	100.3767
Jul-92	101.0759
Aug-92	101.4611
Sep-92	101.9828
Oct-92	102.1881
Nov-92	102.2920
Dec-92	102.8186
Jan-93	103.2888
Feb-93	104.1049
Mar-93	105.1113
Apr-93	105.6293
May-93	106.1820
Jun-93	106.6233
Jul-93	106.8019
Aug-93	107.4194
Sep-93	108.0125
Oct-93	108.3355
Nov-93	108.7919

Dec-93	108.7308
Jan-94	108.5712
Feb-94	108.9765
Mar-94	109.2777
Apr-94	109.9113
May-94	110.7808
Jun-94	111.1488
Jul-94	111.7341
Aug-94	112.2974
Sep-94	112.5598
Oct-94	113.3480
Nov-94	114.0105
Dec-94	114.2943
Jan-95	114.8548
Feb-95	115.0367
Mar-95	115.1811
Apr-95	115.8931
May-95	116.1952
Jun-95	116.4851
Jul-95	116.9225
Aug-95	116.9124
Sep-95	117.2365
Oct-95	117.5056
Nov-95	117.4509
Dec-95	117.7412
Jan-96	117.7990
Feb-96	117.9357
Mar-96	118.4011
Apr-96	118.4062
May-96	118.6296
Jun-96	118.9983
Jul-96	119.0155
Aug-96	119.4665
Sep-96	119.8788
Oct-96	120.1420
Nov-96	120.8534
Dec-96	121.3469
Jan-97	121.8500
Feb-97	122.5697
Mar-97	122.9039
Apr-97	123.3024

May-97	123.8974
Jun-97	124.4047
Jul-97	125.1760
Aug-97	125.8250
Sep-97	126.1133
Oct-97	126.5981
Nov-97	126.9223
Dec-97	127.1887
Jan-98	127.8889
Feb-98	128.3213
Mar-98	128.5627
Apr-98	128.9707
May-98	128.9211
Jun-98	128.9557
Jul-98	129.1676
Aug-98	129.0859
Sep-98	129.5288
Oct-98	130.0356
Nov-98	130.2658
Dec-98	130.8770
Jan-99	131.0651
Feb-99	131.0137
Mar-99	131.4308
Apr-99	131.5734
May-99	131.8436
Jun-99	132.6112
Jul-99	133.2210
Aug-99	133.9685
Sep-99	134.8608
Oct-99	135.3563
Nov-99	135.7749
Dec-99	135.8645
Jan-00	135.4455
Feb-00	135.5101
Mar-00	136.0272
Apr-00	136.5649
May-00	137.1557
Jun-00	137.2971
Jul-00	136.9614
Aug-00	136.9298
Sep-00	137.1909

Oct-00	137.6993
Nov-00	138.3987
Dec-00	138.7041
Jan-01	138.8695
Feb-01	139.0399
Mar-01	139.0572
Apr-01	139.2896
May-01	139.5647
Jun-01	139.5502
Jul-01	139.3797
Aug-01	139.0114
Sep-01	138.4052
Oct-01	137.9556
Nov-01	137.7393
Dec-01	137.5841
Jan-02	137.4579
Feb-02	137.1134
Mar-02	136.4409
Apr-02	135.8811
May-02	135.5263
Jun-02	135.3802
Jul-02	135.5508
Aug-02	135.4532
Sep-02	135.1032
Oct-02	134.8000
Nov-02	134.4096
Dec-02	134.3634
Jan-03	134.5330
Feb-03	134.5844
Mar-03	134.7243
Apr-03	134.3474
May-03	133.6797
Jun-03	133.2828
Jul-03	132.9008
Aug-03	133.0285
Sep-03	133.5851
Oct-03	133.9031
Nov-03	134.2358
Dec-03	134.3588
Jan-04	134.2164
Feb-04	134.4606

Mar-04	134.9741
Apr-04	135.7181
May-04	136.5819
Jun-04	137.0245
Jul-04	137.1133
Aug-04	137.0402
Sep-04	136.7783
Oct-04	136.6170
Nov-04	136.8387
Dec-04	137.4336
Jan-05	138.1600
Feb-05	138.6360
Mar-05	138.9529
Apr-05	139.0343
May-05	139.2057
Jun-05	139.8171
Jul-05	140.2372
Aug-05	140.5804
Sep-05	141.0682
Oct-05	141.0245
Nov-05	141.0968
Dec-05	141.5813
Jan-06	141.7550
Feb-06	142.1292
Mar-06	142.5491
Apr-06	142.4592
May-06	142.7152
Jun-06	142.9806
Jul-06	142.8661
Aug-06	143.4543
Sep-06	143.9442
Oct-06	144.0217
Nov-06	144.7251
Dec-06	144.7721
Jan-07	144.3347
Feb-07	144.4579
Mar-07	144.0268
Apr-07	144.0606
May-07	144.8771
Jun-07	145.0530
Jul-07	145.6505

Aug-07	146.1553
Sep-07	145.6742
Oct-07	145.9254
Nov-07	146.2258
Dec-07	146.3560
Jan-08	147.5079
Feb-08	147.9970
Mar-08	148.0610
Apr-08	148.6442
May-08	148.4005
Jun-08	148.3998
Jul-08	148.7697
Aug-08	148.3416
Sep-08	148.3857
Oct-08	148.3754
Nov-08	147.8345
Dec-08	147.8370
Jan-09	147.2503
Feb-09	146.2739
Mar-09	145.8302
Apr-09	145.0081
May-09	144.2419
Jun-09	143.9541
Jul-09	143.4117
Aug-09	143.0819
Sep-09	142.9961
Oct-09	142.6309
Nov-09	142.3305
Dec-09	141.8837
Jan-10	141.3336
Feb-10	141.2293
Mar-10	141.5287
Apr-10	142.1527
May-10	142.8103
Jun-10	143.1600
Jul-10	143.1343
Aug-10	142.8624
Sep-10	143.0749
Oct-10	143.5749
Nov-10	144.0104
Dec-10	144.9489

Jan-11	145.5121
Feb-11	145.6321
Mar-11	146.0185
Apr-11	145.8413
May-11	145.7310
Jun-11	145.9542
Jul-11	145.6636
Aug-11	145.6924
Sep-11	145.9305
Oct-11	145.9211
Nov-11	146.4350
Dec-11	146.8453
Jan-12	146.8329
Feb-12	147.2350
Mar-12	147.6110
Apr-12	148.0061
May-12	148.9199
Jun-12	149.4965
Jul-12	149.7712
Aug-12	150.4916
Sep-12	150.9128
Oct-12	151.3331
Nov-12	152.1862
Dec-12	152.4481
Jan-13	152.8292
Feb-13	153.6515
Mar-13	153.9647
Apr-13	154.6751
May-13	155.5800
Jun-13	156.0084
Jul-13	156.9477
Aug-13	157.7593
Sep-13	157.9691
Oct-13	158.5731
Nov-13	158.9779
Dec-13	159.1698
Jan-14	159.9624
Feb-14	160.5252
Mar-14	161.0666
Apr-14	161.9833
May-14	162.3735

Jun-14	162.7992
Jul-14	163.4584
Aug-14	163.6392
Sep-14	164.2331
Oct-14	165.0725
Nov-14	165.4892
Dec-14	166.4154
Jan-15	167.2308
Feb-15	167.5570
Mar-15	168.2372
Apr-15	168.5729
May-15	168.6821
Jun-15	169.4624
Jul-15	170.0506
Aug-15	170.4894
Sep-15	171.1062
Oct-15	171.1103
Nov-15	171.2166
Dec-15	171.5623
Jan-16	171.5531
Feb-16	171.9225
Mar-16	172.2729
Apr-16	172.2214
May-16	172.3414
Jun-16	171.9688
Jul-16	171.3694

Vita

Macie Zaynah Subia was born and raised in El Paso, Texas. She graduated number five in her class from Riverside High School in 2010. She was awarded academic scholarships to continue her education at the University of Texas at El Paso (UTEP). While studying at UTEP, she was inducted into four different honor societies which included: Alpha Lambda Delta Honor Society, The National Society of Leadership and Success, Golden Key International Honor Society, and Sigma Alpha Lambda National Leadership and Honors Organization. She received a B.S. in Mathematics with a concentration in Applied Mathematics from UTEP in May 2014 with cum laude honors.

Macie was admitted to the Master of Science in Economics program at UTEP in June 2014 and was employed by the Hunt Institute of Global Competiveness as a research assistant. Her work at the institute contributed to fostering the understanding of the economic development of the Paso del Norte region. To expand her understanding of economics her elective graduate coursework comprised of Applied International Economics, Economic Forecasting, Foreign Policy Decision Making, Panel Data & Discrete Choice Models, Urban Economics, and Border Economics.

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This thesis was typed by Macie Zaynah Subia.