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Southern Border Recession Predictability in the United States: 1990-2015

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Comments:
Technical Report TX17-1
A revised version of this study is forthcoming in *Applied Economics.*

THE UNIVERSITY OF TEXAS AT EL PASO

UTEP BORDER REGION MODELING PROJECT

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UTEP Border Region Econometric Modeling Project

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SOUTHERN BORDER RECESSION PREDICTABILITY IN THE UNITED STATES: 1990-2015*

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ABSTRACT

Prior research establishes that the spread between long- and short-term bond yields often provides valuable information for predicting business cycle downturns. This study examines the predictive capacity of the yield spread for United States metropolitan economies situated along the border with Mexico. Because of the location of these urban economies and various economic ties linking them with twin cities across the border, the Mexico yield spread, and the real dollar/peso exchange rate are also employed as potential recession predictors. Results suggest that a flattening of the yield curve for either country tends to increase the probability of recessions in border economies. Furthermore, declines in the real value of the peso, which are typically associated with greater cross-border manufacturing activity, are found to reduce recession likelihoods in the metropolitan economies examined on the north side of the international boundary.

JEL Categories: E32, Business Cycles; E43, Interest Rates; R15, Regional Econometric Models

Keywords: Recession Prediction; Yield Curves; Real Exchange Rates

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INTRODUCTION

Economic recession prediction has received substantial attention in recent years. The topic is clearly relevant to decision making in both the public and private sectors. Unemployment, business bankruptcies, and personal bankruptcies all increase during business cycles downturns. However, it is difficult to identify reliable precursors of business cycle downturns. One widely touted candidate is the difference between the yields of long-run treasury bonds and short run treasury bills, commonly known as the yield spread (Estrella and Mishkin 1996; Dueker 1997; Kauppi and Saikkonen 2008; Nyberg 2010).

Estrella and Mishkin (1998) compare the effectiveness of different economic variables that can potentially help predict recessions. These variables are interest rates, interest rate spreads, stock price indexes, and monetary aggregates. The yield spread is found to be the indicator with the most predictive power. A major advantage of the yield spread is that it predicts recessions relatively well at longer lead times (more than 6 months). In contrast, the other indicators often prove to be more reliable in the short-run (6 months or less). For regional economies, the slope of the yield curve has also been found to help forecast downturns (Gauger and Schunk, 2002; Shoesmith, 2003).

This paper examines the ability of the yield spread (difference between the 10-year Treasury bond rate and the 3-month Treasury bill rate) to predict recessions for the eight largest metropolitan economies along the United States southern border with Mexico. Varying degrees of economic interdependence exist between the border urban economies and the adjacent sister municipalities across the international boundary in Mexico. Given that, international variables are also included in the sample. Those variables include a dollar/peso real exchange rate and the yield curve for Mexico (the difference between the 1-year and the 3-month Treasury bill rates). The following section provides a literature review. The data and methodology are then discussed, followed by a presentation of the empirical results, and a concluding summary.

LITERATURE REVIEW

Mishkin (1990) asks at which term (whether short-run or long-run) yield curves are more accurate in predicting recessions. By using interest rates from treasury bonds with maturities of up to five years, multiple yield spreads are calculated. When using interest rates for instruments with maturities of less than six months, the term structure of interest rates contains almost no information about the path of future inflation. However, the predictive power of the term structure appears to increase as the length of the maturities increases. For interest rates of instruments with maturities greater than 9 months, the term structure is more reliable at predicting recessions.

An even longer yield spread, the difference between the ten-year Treasury bond and the three-month Treasury bill interest rates, is used in Estrella and Mishkin (1996). That spread is used to analyse three common recession indicators. For lead times of more than 6 months, that yield spread proves to be the most effective predictor of recessions. Estrella and Mishkin (1998) analyse additional variables as potential recession predictors. The list includes interest rates, other interest rate spreads, stock price indexes, and monetary aggregates. The results indicate that the yield spread has the most predictive power, but only for lead times of one quarter or more in advance of downturns.

Most early models use binary recession indicators as dependent variables, but not as right-hand side regressors. Such indicators take a value of 1 if there is a recession and 0 if not. A drawback of static binary response models is a lack of a dynamic structures that take into account dependent variable autocorrelation. By including a lag of the binary recession indicator, the predictive power of the yield curve often increases and out of sample simulations become more reliable (Dueker, 1997; Kauppi and Saikkonen, 2008).

In many developing economies, including Mexico, this kind of research has not yet been extensively employed. Financial data constraints often prove binding. Longer maturity financial instruments do not exist in many developing economies, which prevents the calculation of longer term yield spreads. Gonzalez, Spencer, and Walz (2000) study the predictive power of the yield curve in Mexico. Due to interest rate data constraints, the yield spread is defined as the difference between one month and six month bond interest rates. The yield spread proves to be an adequate predictor of recessions in Mexico for some time periods but not for others.

Mohapi and Botha (2013) employ a dynamic autoregressive probit model to predict recessions in South Africa. Given the dependence of smaller economies on larger economies, yield spreads of other economies (China, U.S.A., and Germany), are used as independent variables in several different probit models. Negative correlation is found for the Chinese and United States yield spreads as expected, but the German spread is found to be countercyclical. Similarly, Mehl (2009) finds that the United States and euro area yield curves contain information that is useful for predicting changes in inflation and industrial production in various emerging economies.

Several studies also consider the impacts of yield spreads in foreign countries on business cycles in high-income economies. Nyberg (2010) reports that the United States and German term spreads are useful for forecasting both domestic and foreign recessions. Similarly, Bernard and Gerlach (1998) find that interest rate differentials in both of those countries help predict recessions in some other developed countries. In a study of stock markets in Canada, Australia, and six European countries, Liu, Resnick, and Shoesmith (2004) report that the United States yield spread contains more market-timing information than the home-country yield spreads. Plosser and Rouwenhorst (1994) find evidence that the term structure of interest rates in the United States embodies information that is useful for predicting industrial production growth in Germany and the United Kingdom and that the yield spreads of the latter two countries also help predict United States growth.

Mehl (2009) documents that yield spreads in high-income countries serve as bellwethers for business cycle movements in many developing nations. However, relatively little is known about the cross-border predictive capabilities of emerging-economy yield spreads. Regions of the United States that are located immediately adjacent to Mexico are appropriate settings to test the hypothesis that an emerging-economy yield spread, that of Mexico, can help predict regional business cycles in a high-income country. Businesses in these regional economies rely on cross-border shoppers and other clientele living directly across the international boundary. Recessions in Mexico therefore have potentially serious adverse repercussions for local economic activity on the northern side of the border (Fullerton, 2001; Phillips and Cañas, 2008). One contribution of this analysis is to examine whether Mexico's yield spread helps signal the onset of recessions in United States border cities. In addition, this research will also evaluate the predictive potential of another cross-border variable, the real dollar/peso exchange rate

The vast majority of recession prediction research has been conducted for national economies, but a few regional studies have also been completed. One of those studies was developed using data for eight multi-state regions in the United States (Gauger and Schunk, 2002). A similar effort employs data for each of the 50 states (Shoesmith, 2003). Probit results in both studies exhibit reliable predictive properties for forecasting regional economic contractions.

The objective of this study is to develop probit recession models for eight of the most important United States metropolitan economies along the border with Mexico. Those economies encompass the following Metropolitan and Micropolitan Statistical Areas: San Diego, CA; El Centro, CA; Yuma, AZ; Nogales, AZ; El Paso, TX; Laredo, TX; McAllen, TX; and Brownsville, TX. The total combined population of these urban areas in 2010 was 5.7 million (USCB, 2010). In that year, 87 percent of all personal vehicle border crossings from Mexico to the United States, totalling more than 55 million, occurred within these urban areas (BTS, 2016a). These cities also handled 70 percent of Mexico's 2010 trade with the United States with a value of $276 billion (BTS, 2016b). Because the eight urban areas listed above host a large percentage of the economic exchanges between the United States and Mexico, they are well suited for testing hypotheses regarding cross-border predictors of regional business cycles.

METHODOLOGY

A probit model is used to estimate the probability of recession in a particular time period. This approach has been used to predict recessions in multiple countries. A static probit model can be written as shown below.

$$\mathbf{Pr}(Y_t=1)=F(\beta_0+\beta_1 X_{t-k}) \qquad (1)$$

In **Equation (1)**, Pr is the probability of an existing recession (Y_t = 1 if a recession is underway at time t, 0 if not), X_{t-k} is an explanatory variable at time t-k, β_0 and β_1 are parameters that will be estimated, and F is used to represent the cumulative normal distribution function.

One drawback of the static model is that it does not take advantage of information embedded within the autocorrelation structure of the binary recession indicator. Alternatively, dynamic probit model specifications take into account prior states of the economy by including a lag of the dependent variable as shown in **Equation (2)**.

$$\mathbf{Pr}(Y_t=1)=F(\beta_0+\beta_1 X_{t-k}+\beta_2 Y_{t-1}) \qquad (2)$$

Kauppi and Saikonnen (2008) find that dynamic probit models tend to outperform static specifications for predicting national economic downturns in the United States. Furthermore, Dueker (1997) argues that the dynamic version of the probit model is better suited to handling problems such as serial correlation that frequently arise in the context of time series modelling. The model in **Equation (2)** can be augmented with additional explanatory variables. Standard selection criteria such as pseudo-R^2 can be used to identify which lags of candidate explanatory variables to include in an equation (Nyberg, 2010).

To help select estimated equation functional form, the pseudo-R^2 metric developed by Estrella (1998) is employed. The metric is calculated as shown below.

$$\textit{Adjusted Pseudo-}R^2 = 1-(L_u/L_c)^{-(2/n)\,L_c} \qquad (3)$$

In **Equation (3)**, L_u is the unconstrained maximum value of the log-likelihood, L_c is the constrained maximum value of the log-likelihood assuming all coefficients except the constant are zero, and n is the sample size. Standard diagnostic measures such the t-statistic are also utilized.

The modelling framework employed in this study posits probabilities of recession in the United States-Mexico border region as functions of macroeconomic variables in both countries. This is consistent with the framework outlined by Fullerton (2001), in which national-level and bi-national economic indicators serve as predictors for border region economic performance. Prior studies have found, in particular, that the dollar/peso exchange rate strongly influences business activity along the border (Patrick and Renforth, 1996; Coronado and Phillips, 2007). This study extends previous work on business cycle modelling for this border region by analysing the potential predictive power of the United States and Mexico yield spreads.

The dichotomous dependent variables identify downturns in each metropolitan economy. According to Klein and Moore (1983), the binary variables can be constructed using the coincident values of the unemployment growth rate for each period. Thus, the dependent variables are defined on the basis of quarterly growth in seasonally adjusted local unemployment rates. A common definition of recession is two consecutive quarters (or more) of negative growth. Because unemployment rates are used, two consecutive quarters of positive growth is used instead of negative growth. The United States yield spread is defined as the 10-year Treasury bond rate minus the 3-month Treasury bill rate. In addition to this variable, a 5-year versus 3-month interest rate differential is also calculated to serve as an alternative yield spread measure. All unemployment and United States interest rate data are from the Federal Reserve Bank of St. Louis (FRED, 2015).

Philips and Cañas (2008) find that economic conditions in Mexico sometimes have pronounced impacts on the business cycles of United States border cities. Due to the close economic ties between the cities selected for this study and their cross-border counterparts in Mexico, international economic variables are also included in the sample. A dollar/peso (USD/MXN) real exchange rate index is obtained from the University of Texas at El Paso Border Region Modeling Project. Also, the difference between interest rates for 1-year and 3-month Treasury bills (CETES) is used to define a yield spread variable for Mexico. An alternative yield spread variable for Mexico is calculated as the difference between yields on 1-year and 1-month CETES. The latter interest rate data are obtained from the central bank (BM, 2015).

By incorporating all of the variables that are used in the model, the equation to be estimated takes the form shown in **(4)**.

$$\Pr(Y_t=1)=F(\beta_0+\beta_1\ USSP_{t-h}+\beta_2\ MXSP_{t-j}+\beta_3\ REXR_{t-k}+\ \beta_4\ Y_{t-1}+\varepsilon_t) \qquad (4)$$

In **Equation (4)**, USSP is the United States yield spread, MXSP is the yield spread for Mexico, REXR is the inflation adjusted dollar/peso exchange rate index, and Y_{t-1} is a lag of the dependent variable. This model is estimated for each of the metropolitan economies mentioned above.

Equation (4) is used to examine whether the yield spreads and the real exchange rate index can help predict recessions in the eight border economies comprising the sample. A decrease in the United States yield spread, which entails higher short-term interest rates and/or lower long-term rates, is hypothesized to increase the probability that a recession will occur in future quarters. That is because high short-term interest rates are often associated with contractionary monetary policy and lower long-term rates may reflect expectations of an economic slowdown in coming years (Dueker, 1997).

For similar reasons, the yield spread for Mexico is expected to have an inverse relationship with the probability of recession. Economic slowdowns in Mexico may coincide with downturns in cities on the north side of the border for a variety of reasons. First, retail sectors in many United States border cities rely on a steady influx of Mexican shoppers and sales tend to decline when such shoppers reduce consumption, as typically occurs when Mexico faces a recession (Coronado and Phillips, 2007; Phillips and Cañas, 2008). Other sectors of border city economies such as freight transportation, wholesale trade, and financial services also rely on customers located in Mexico (Cañas et al., 2013). Thus, a higher probability of recession in Mexico, as signalled by a flattening or inversion of that country's yield curve, is hypothesized to increase the probability of recession on the north side of the border.

There is not sufficient evidence to advance a specific hypothesis regarding the impact of the real exchange rate on border city economies. Some prior research suggests that peso depreciations can have strong adverse impacts on retail sectors in United States border cities (Patrick and Renforth, 1996). However, peso depreciations also tend to stimulate export-processing activity in Mexican border cities, which may help fuel economic activity on the north side of the border (Niño et al., 2015). If a real depreciation of the peso lowers the probability of recession for any of the border economies examined, then the exchange rate coefficients will be negative. The converse will occur if peso weakness increases the likelihood of a business cycle downturn.

Correlations between the explanatory variables from **Equation (4)** are shown in **Table 1**. The United States and Mexico yield spreads exhibit a weak positive correlation. The small magnitude of this correlation coefficient is likely due to the fact that, over the course of the sample period, the yield curves of the two countries have not always evolved in similar patterns. The lowest value of Mexico's yield spread during the sample period, -10.8 percent, occurred in the first quarter of 1995 at a time when the United States yield spread remained well above zero. The large dip in MXSP in 1994-1995 signalled the onset of a very severe recession in Mexico that had no counterpart in the United States. It is also noteworthy that lower yield spreads in both Mexico and the United States are associated with real peso depreciations. This suggests that signs of economic slowdowns in both Mexico and its largest trading partner often coincide with lower currency market values for the peso.

Table 1. Explanatory Variable Correlation Coefficients

	USSP	MXSP	REXR
USSP	1.000		
MXSP	0.120	1.000	
REXR	-0.226	-0.464	1.000

Note: The sample period analyzed is 1990:Q4 to 2015:Q3.

EMPIRICAL RESULTS

As noted above, a series of equations is estimated for each metropolitan area. Model selection is accomplished by taking into account pseudo-R^2 values, the plausibility of lag lengths, and the number of statistically significant coefficients (Gauger and Schunk, 2002; Nyberg, 2010; Mohapi and Botha, 2013). Dynamic terms are included in the model to take into account potential autocorrelation structures of the dependent variables. Given that, no specific interpretations are attempted for these coefficients (Ng, 2012). The data used for estimation span 25 years, from the fourth quarter of 1990 to the third quarter of 2015. Estimation results are summarized in **Tables 2 and 3**.

All of the yield spread parameter estimates have negative signs as hypothesized. The United States yield spread predicts recessions with leads of six to nine quarters suggesting that this variable provides ample advance warning of potential economic downturns in these border economies. Some other studies find that yield spreads contain useful information for predicting recessions at least two years into the future (Gauger and Schunk, 2002; Nakaota, 2005; Mehl, 2009). However, most of the prior literature suggests that lead times of six quarters or less are more commonly observed (Estrella and Mishkin, 1998; Shoesmith, 2003).

One factor that may help explain the comparatively long lead times for some urban economies considered in this study is the relatively large role of the public sector in these economies. On average, between 1990 and 2015, government employment accounted for between 18 and 37 percent of total nonfarm employment in these urban areas, compared to 16 percent for the United States as a whole (BLS, 2016). Many of the US-Mexico border cities have relatively high concentrations of customs, border security, social services and/or military-related employment. Given the large public sector footprint in the border region, countercyclical public spending may somewhat offset or delay the local impacts of national recessions due to public budgeting mechanics.

For all of the urban economies examined, the lead times for the Mexico yield spread are shorter than those for the United States yield spread, ranging from one to five quarters. The shorter lead times for the Mexico yield spread may be partially attributed to the way that it is defined. Because the long-term Treasury bills used to define the Mexican yield spread have a maturity of only one year, it is likely that MXSP provides information on recessionary expectations for a time horizon of around one year or less. The longest lead time observed, that for San Diego, is only slightly longer than one year and all of the other lead times reported in **Tables 2 and 3** are between one and three quarters. Similarly, Reyna-Cerecero, Salazar-Cavazos, and Salgado-Banda (2008) find that the 1-year minus 3-month Mexico yield spread generally has higher explanatory power for lead times of two quarters or less.

As previously mentioned, the yield spread can be defined in different ways. To assess the robustness of the yield spread parameter estimates reported in **Tables 2 and 3**, the equations are sequentially re-estimated using alternative definitions of both the Mexico and U.S. yield spreads (the results are not tabulated). A 5-year minus 3-month U.S. yield spread is estimated to have somewhat larger impacts on the probability of recession (in terms of absolute value) than those shown in **Tables 2 and 3**, although the standard errors of the estimated yield spread coefficients are also larger. Estimated coefficients for a 1-year minus 1-month interest rate differential variable for Mexico are slightly larger for five out of the eight cities. Regardless of the specific yield spread variable utilized, the parameter estimates change relatively little and always maintain the same signs as those reported in **Tables 2 and 3**.

Table 2. Estimation Results for California and Arizona Border Cities

	San Diego	El Centro	Yuma	Nogales
Model	**Dynamic**	**Dynamic**	**Dynamic**	**Dynamic**
$USSP_{t-6}$		-0.243575**		
$USSP_{t-9}$	-0.833461**		-0.244392*	-0.273505**
$MXSP_{t-1}$		-0.266303**		
$MXSP_{t-3}$			-0.010819	-0.379842***
$MXSP_{t-5}$	-0.245676***			
REX_{t-1}	-0.050393**			-0.031803*
REX_{t-8}		-0.043194**	-0.013254	
y_{t-1}	1.841782***	1.492645***	1.698913***	2.119707***
Constant	4.572127*	3.662514*	0.712754	2.415482
Pseudo-R^2	0.715799	0.441343	0.415210	0.554550
Log-likelihood	-18.35125	-39.42880	-41.66594	-32.61615
Akaike Info. Criterion	0.513214	0.965844	1.025625	0.826728
Likelihood Ratio Stat.	70.29571***	43.36929***	40.33705***	55.04378***

Note: The sample period analyzed is 1990:Q4 to 2015:Q3.

* Statistically significant at 10%

** Statistically significant at 5%

*** Statistically significant at 1%

Table 3. Estimation Results for Texas Border Cities

	El Paso	Laredo	McAllen	Brownsville
Model	**Dynamic**	**Dynamic**	**Dynamic**	**Dynamic**
$USSP_{t-6}$		-0.455950***	-0.284469*	-0.321527**
$USSP_{t-9}$	-0.297215**			
$MXSP_{t-1}$				-0.144953*
$MXSP_{t-2}$	-0.180982*	-0.085532	-0.138004*	
REX_{t-4}	-0.045661**	-0.074906***	-0.025614	0.000795
y_{t-1}	1.472176***	1.385111***	2.269207***	1.669666***
Constant	3.758856*	6.740427***	1.361657	-0.702318
Pseudo-R^2	0.404745	0.493109	0.518903	0.356789
Log-likelihood	-34.41404	-32.77413	-23.99703	-37.19735
Akaike Info. Criterion	0.866243	0.803705	0.616958	0.897816
Likelihood Ratio Stat.	38.17012***	48.95328***	49.31443***	34.49423***

Note: The sample period analyzed is 1990:Q4 to 2015:Q3.

* Statistically significant at 10%

** Statistically significant at 5%

*** Statistically significant at 1

The results in **Tables 2 and 3** also indicate that a real depreciation of the peso relative to the dollar signals a lower probability of recession in most of the United States border cities considered. The impact of exchange rates on the probability of recession in Brownsville is positive but insignificant. One possible explanation for an inverse relationship between the exchange rate variable and most of the binary recession indicators is suggested by the tendency of export-processing activity in Mexican border cities to expand when the peso depreciates (Coronado, Fullerton, and Clark, 2004; Fullerton and Torres-Ruiz, 2004; Cañas, Fullerton and Smith, 2007). Factors that increase cross-border manufacturing activity may lead to positive spill-over effects for cities on the north side of the border (Hanson, 1996; 2001; Varella-Mollick, Cortez-Rayas and Olivas-Moncisvais, 2006; Cañas et al., 2013). As in the case of the yield curve coefficients, the exchange rate coefficients vary considerably depending on the specific city examined.

Prior research suggests that the yield curve may have greater predictive power for regions dominated by industries such as manufacturing and construction that are sensitive to changes in interest rates (Gauger and Schunk, 2002). Baghestani and Kaya (2016) report that yield spread variations affect real estate market dynamics. Shoesmith (2003) finds that changes in interest rate spreads have strong impacts on manufacturing-intensive states. To consider whether patterns of regional variation in predictive performance documented in earlier studies generalize to border economies, data on the share of manufacturing and construction employment in total employment are collected for each urban area. Several of these urban economies have prominent transportation and warehousing sectors that transport cross-border manufactured goods (Cañas et al., 2013). Transportation and warehousing employment is also likely to be fairly cyclical with respect to interest rate fluctuations.

Table 4 indicates that the yield spread seems to have relatively strong predictive capacity among cities with high concentrations of interest-rate-sensitive employment sectors (construction, manufacturing, transportation, and warehousing). The yield spread has the greatest predictive power, as judged by the likelihood ratio statistics, in San Diego, Nogales, El Paso, and Laredo. Of those metropolitan economies, the last three also have the highest proportions of construction, manufacturing, and transportation employment among the eight urban areas considered. Though not conclusive, these results point to one possible explanation underlying the regional variation observed in the predictive power of the yield spread variables.

In-sample simulations are also completed to examine if the model can predict recessions. **Figures 1 through 8** graph the actual and fitted values of the dependent variables for each urban economy in the sample. Each graph measures the probability of recession on the vertical axis. The existing literature employs various different probability thresholds to identify likely periods of recession. For example, Ng (2012) classifies months with probability values greater than 50 percent as recession periods because lower thresholds increase the likelihood of false signals. Nyberg (2010) defines probability values between 25 and 50 percent as weak recession signals, whereas values over 50 percent are strong signals of a likely economic downturn. The rationale for considering probability values as low as 25 percent as signals of a possible recession is the potential asymmetry in market participant valuations of correctly predicting recessions versus correctly predicting expansions. Businesses may be more concerned about failing to anticipate an oncoming recession than preparing for a recession that does not materialize (Dueker, 2002).

Table 4. Regional Industry Shares and the Predictive Power of the Yield Spread

	Industry Share of Total Employment*		
	Construction & Manufacturing	**Construction, Manufacturing & Transportation**	**Likelihood Ratio Test Statistic****
San Diego	11.3853	13.0337	20.77024
El Centro	7.2164	10.7433	4.24234
Yuma	8.7460	10.8384	6.85556
Nogales	7.4956	15.9305	21.10336
El Paso	12.6287	17.3027	13.36554
Laredo	5.4762	18.8150	14.38052
McAllen	9.6165	13.2203	4.01024
Brownsville	10.1784	14.0912	6.94082

* Employment data are for the period 2001-2014; the data are from the Bureau of Economic Analysis.

** The 5% critical value of the chi-squared distribution is 5.99; the null hypothesis is that excluding both yield spread coefficients does not significantly reduce the fit of the model.

Figure 1. San Diego Actual and Fitted values

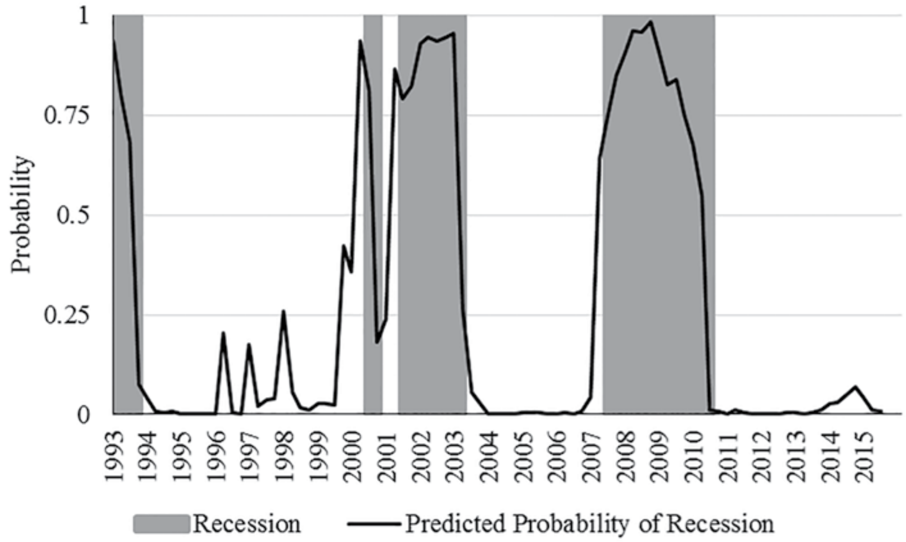


Figure 2. El Centro Actual and Fitted Values

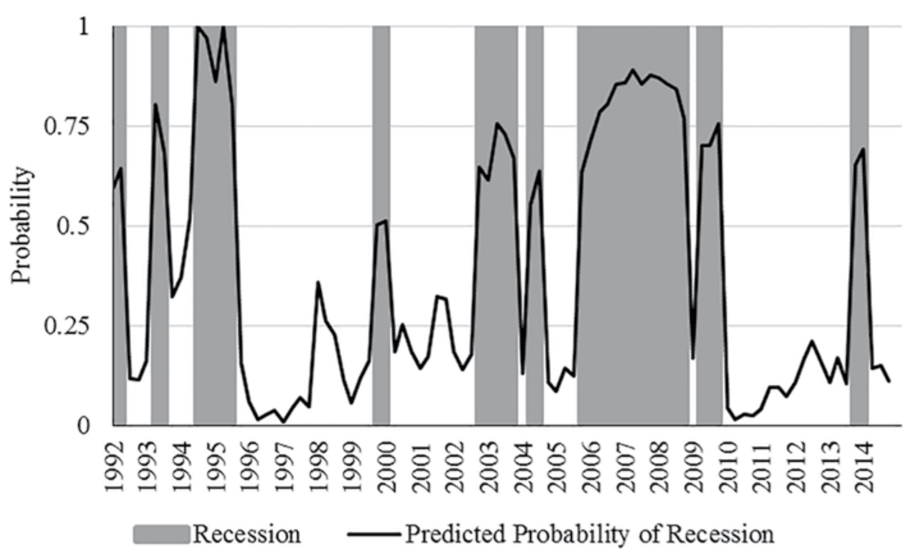


Figure 3. Yuma Actual and Ffitted values

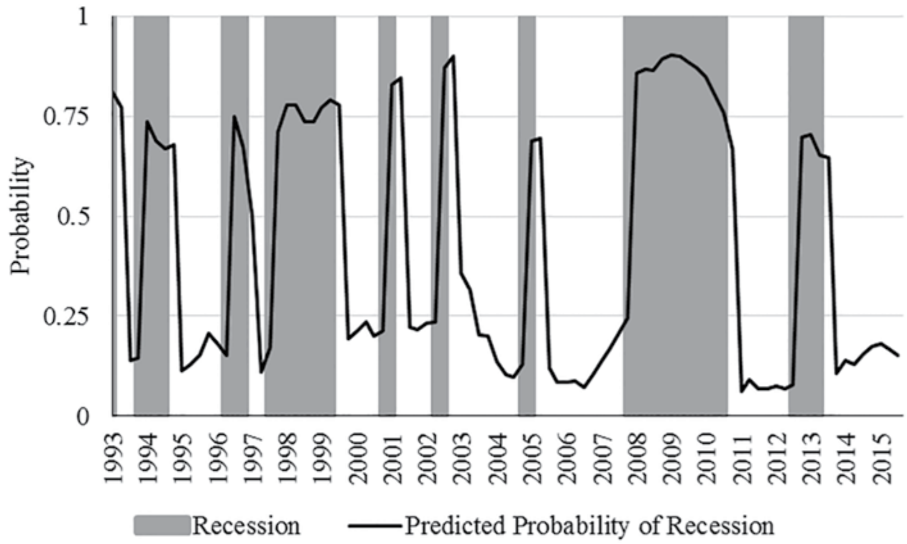


Figure 4. Nogales Actual and Fitted Values

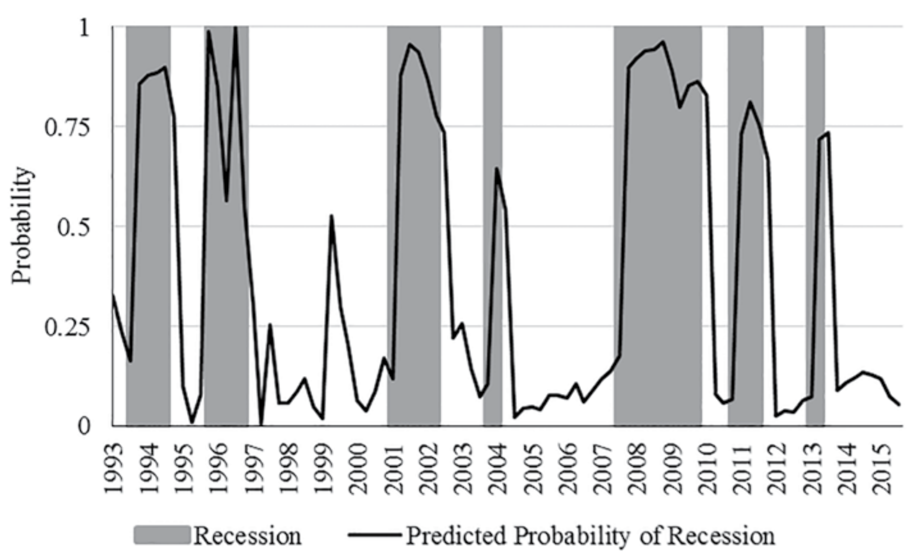


Figure 5. El Paso Actual and Fitted Values

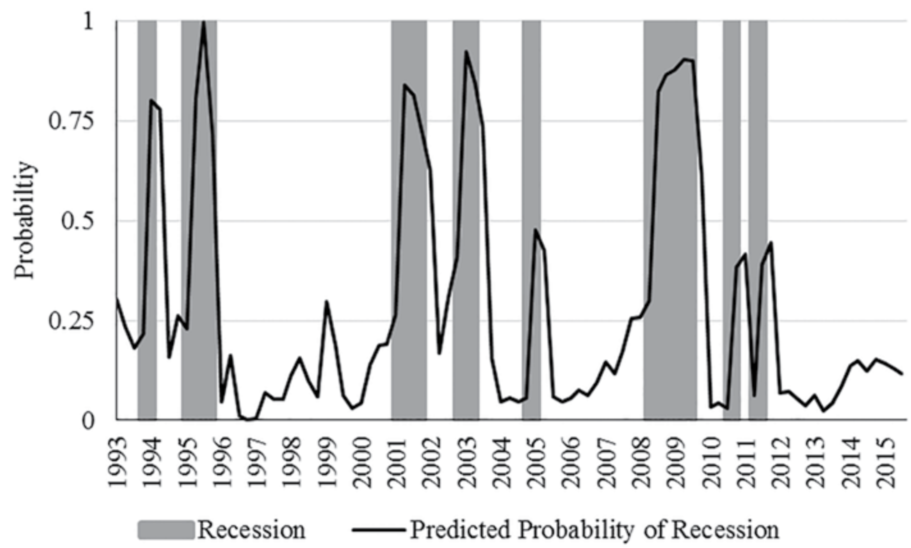


Figure 6. Laredo Actual and Fitted Values

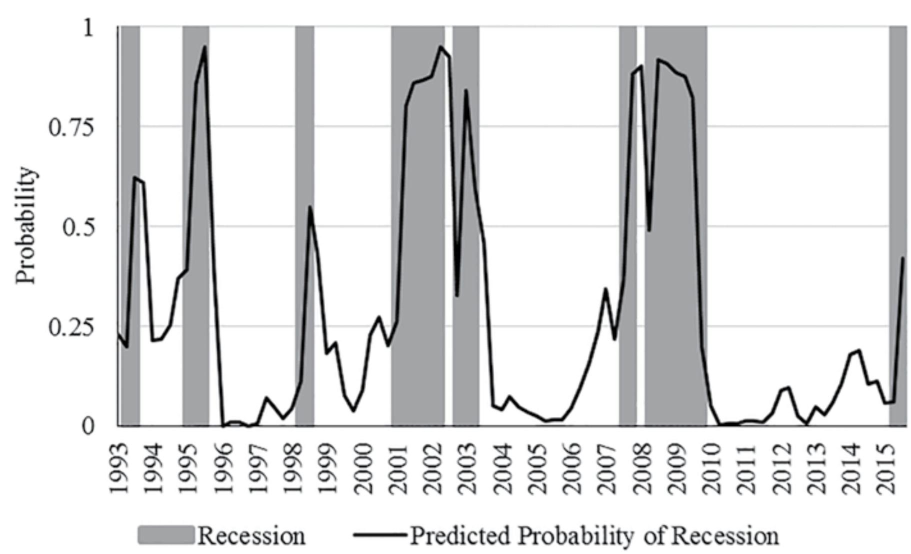


Figure 7. McAllen Actual and Fitted Values

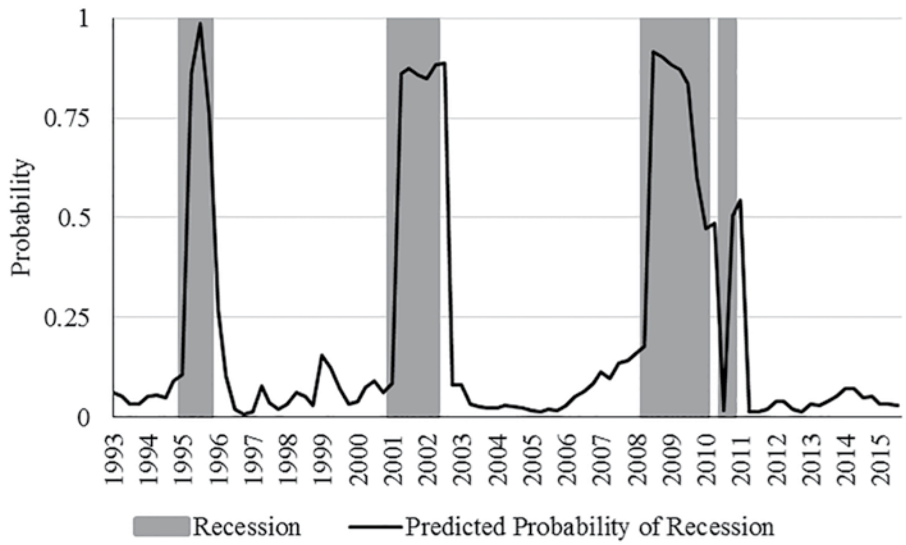
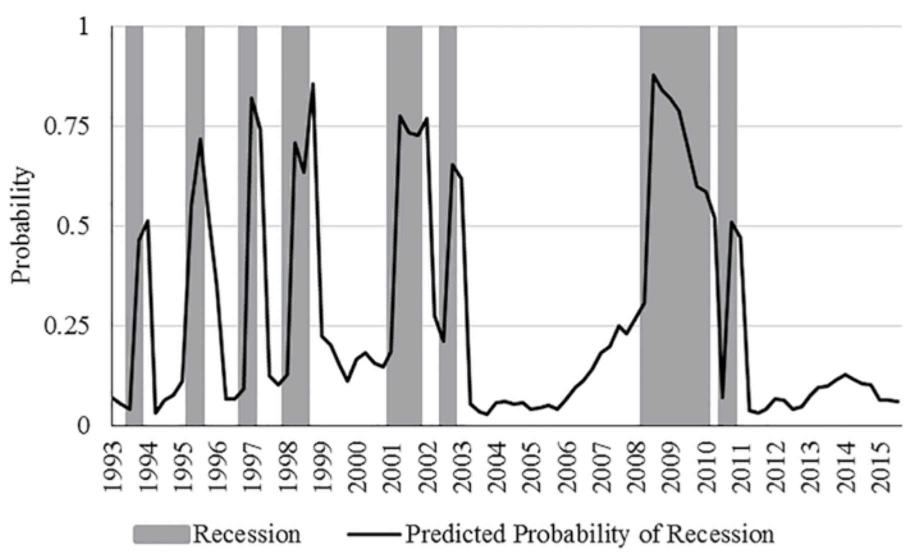


Figure 8. Brownsville Actual and Fitted Values



The dynamic probit models estimated for each border economy provide generally adequate information regarding the probability of recessions. In most cases, predicted probabilities exceed 50 percent during periods when recessions actually occurred. Predicted probabilities tend to fall below 50 percent during expansionary phases of local business cycles. For El Paso and Laredo, there is at least one economic downturn that is not correctly predicted when a 50-percent probability threshold is employed as the basis for defining a likely recession period. However, the probability values in those cases do surpass the 25-percent 'weak recession signal' criterion.

CONCLUSION

Modelling and predicting recessions for border economies is a difficult task due to the complex interplay of domestic and international factors affecting those urban areas. In recognition of these factors, the real dollar/peso exchange rate and a yield spread for interest rates in Mexico are employed in this study in addition to the domestic yield spread. Most prior research focuses on domestic yield spreads as the principal recession prediction tool (Estrella, 2005). Also, most studies are done at a national level, with very few conducted at a regional level (Gauger and Schunk, 2002; Shoesmith, 2003). Most of those efforts show that yield spreads are effective as recession predictors due to close relationships with business cycles.

The United States yield spread is a reliable predictor of economic downturns in the United States-Mexico border region, with statistical significance at the 5-percent level across six of the eight metropolitan economies in the sample. Furthermore, the Mexico yield spread is a significant predictor for three out of eight cities, while the real exchange rate is helpful in four cases. At least one of the two cross-border financial and currency-market variables is a significant recession predictor for five of the eight urban areas. The predictive power of cross-border variables confirms that several of the sub-regions along the southern border of the United States are markedly influenced by economic conditions in Mexico. As in previous studies, regional variations in industry structure may help explain why interest rate differentials are more effective predictors of recessions in certain areas. In particular, the prevalence of cross-border freight transportation in local economies may account for some portion of the observed variations in the predictive power of the yield spread. Finally, in-sample simulations confirm the predictive capacity of the models used in this study.

Future research might obtain better results when more data are available, especially for the Mexico yield spread. Better results are sometimes obtained as the maturity differential between long- and short-term instruments increases (Mishkin, 1990). Consequently, when more data for longer term interest rates become available, improved outcomes might result. Additionally, time series data on municipal bond yields for specific metropolitan areas might allow calculation of local-area yield spreads, which could potentially facilitate more nuanced analysis of regional business cycles. Such data sources might help business and policy analysts gain better insights into future economic prospects and may also facilitate more finely tuned policy decisions.

From a geographic perspective, this effort concentrates solely on border economies near Mexico. Additional research using data for regional economies along the border between Canada and the United States would help shed additional light on this topic. Logical candidates for inclusion in such a sample on the southern side of that boundary would include Bellingham, WA; Great Falls, MT; Duluth, MN; Detroit, MI; and Buffalo, NY. Border business cycles are frequently out-of-step with national business cycles. Analysis of economies along the border between Canada and the United States would enjoy an advantage of having both long-term and short-term interest rate data available for modelling purposes.

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Professor Barraza is an award winning economist who has taught at several universities in Mexico and has published in academic research journals in Mexico, Europe, and the United States. Dr. Barraza currently serves as Research Provost at UACJ. Professor Fullerton has authored econometric studies published in academic research journals of North America, Europe, South America, Asia, Africa, and Australia. Dr. Fullerton has delivered economics lectures in Canada, Colombia, Ecuador, Finland, Germany, Japan, Korea, Mexico, the United Kingdom, the United States, and Venezuela.

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