8-2021

Ciudad Juarez Exchange Rate Sell-Buy Spreads: 2009-2016

Thomas M. Fullerton Jr.

Francisco J. Pallares

Comments:
Technical Report TX21-2
A revised version of this study is forthcoming in *International Trade Journal.*
T.M. Fullerton, Jr. and F.J. Pallares, *Ciudad Juarez Sell-Buy Exchange Rate Spreads: 2009-2016*, Technical Report TX21-1, El Paso, TX: University of Texas at El Paso Border Region Modeling Project.

THE UNIVERSITY OF TEXAS AT EL PASO

UTEP BORDER REGION MODELING PROJECT

TECHNICAL REPORT TX21-2

CIUDAD JUAREZ EXCHANGE RATE SELL-BUY SPREADS: 2009-2016

This technical report is a publication of the Border Region Modeling Project and the Department of Economics & Finance at The University of Texas at El Paso.
For additional **Border Region** information, please visit the
www.utep.edu/business/border-region-modeling-project
section of the UTEP web site.

Please send comments to Border Region Modeling Project - CBA 236, Department of Economics & Finance, 500 West University, El Paso, TX 79968-0543.

UTEP Border Region Econometric Modeling Project

Corporate and Institutional Sponsors:

El Paso Water
TFCU
National Science Foundation
UTEP College of Business Administration
UTEP Department of Economics & Finance
UTEP Center for the Study of Western Hemispheric Trade

Special thanks are given to the corporate and institutional sponsors of the UTEP Border Region Econometric Modeling Project. In particular, El Paso Water and The University of Texas at El Paso have invested substantial time, effort, and financial resources in making this research project possible.

Continued maintenance and expansion of the UTEP business modeling system requires ongoing financial support. For information on potential means for supporting this research effort, please contact Border Region Modeling Project - CBA 236, Department of Economics & Finance, 500 West University, El Paso, TX 79968-0543.

CIUDAD JUAREZ EXCHANGE RATE SELL-BUY SPREADS: 2009-2016*

Thomas M. Fullerton, Jr.
Department of Economics & Finance
The University of Texas at El Paso
El Paso, TX 79968-0543, USA
Telephone: 1-915-747-7747
Facsimile: 1-915-747-6282
Email: tomf@utep.edu

Francisco J. Pallares
City of Las Cruces Economic Development
Department, PO Box 20000
Las Cruces, NM 88004
Telephone: 1-575-528-3060
Email fpallares@las-cruces.org

Abstract
Commercial banks and currency kiosk bureaus provide exchange services throughout Ciudad Juarez, Mexico, a large metropolitan economy located on the border with the United States. This study employs newspaper data to examine how the bank and kiosk sell-buy spreads are affected by fluctuations in the total number of northbound border crossers, variations in bilateral peso per dollar exchange rate, and the yield differential between 90-day Certificados de Tesorería (Mexico CETES) and 90-day U.S. Treasury Bills. The sample is comprised of monthly frequency data from January 2009 through June 2016. Parameter estimation is carried out using a GLS ARMAX procedure. Empirical results indicate that the two sets of sell-buy spreads behave very differently from each other. Bank spreads increase as the peso weakens. Exchange bureau spreads decrease as cross-border traffic flows increase. Currency kiosk spreads tend to widen as 90-day yield gaps become larger.

Key Words
Currency Markets, Border Economics, Sell-Buy Spreads

JEL Classifications
F31 Foreign Exchange; M21 Business Economics; R15 Regional Econometrics

Data Availability Statement
Data employed for this study are archived within the Border Region Modeling Project section of The University of Texas at El Paso Library ScholarWorks data repository.

Acknowledgements
Financial support for this research was provided by El Paso Water, National Science Foundation Grant DRL-1740695, Texas Department of Transportation ICC 24-0XXIA001, TFCU, and the UTEP Center for the Study of Western Hemispheric Trade. Helpful comments and suggestions were provided by Steven Fullerton and two anonymous referees.

* A revised version of this study is forthcoming in ***International Trade Journal.***

INTRODUCTION

Exchange rates are often studied in macroeconomic contexts that examine short-run currency market dynamics and/or long-run purchasing power parity fluctuations (Papell, 2006; Gabaix and Maggiori, 2015; Galstyan and Velic, 2017). Dual exchange rates, usually official and parallel or black market rates, have also been analyzed for many developing economies (Bahmani-Oskooee, Hegerty, and Tanku, 2010; Baharumshah, Mohd, and Soon, 2011). A separate branch of the literature examines geographic exchange rate differences that reflect trade patterns and other microeconomic factors such as regional price gaps (Clark, Sawyer, and Sprinkle, 1999; Fullerton and Coronado, 2001; Blanco-Gonzalez and Fullerton, 2006; Fullerton and Varella, 2013). While these efforts frequently uncover intriguing insights regarding currency markets and international economic performance, less attention has been devoted to exchange rate patterns within specific geographic regions that do not involve parallel or black market rates.

This study assembles a unique regional sample of peso per dollar exchange rate data from Ciudad Juarez, Chihuahua, Mexico, a large metropolitan economy adjacent to El Paso, Texas, USA. Local daily exchange rate data from commercial banks and currency bureaus in Ciudad Juarez are collected for a period that covers January 2009 to June 2016. Currency bureaus are also known as currency kiosks, currency exchanges, money exchanges, exchange bureaus, money offices, exchange houses, and currency offices. In Ciudad Juarez, the vast majority of all currency transactions solely involve peso-to-dollar conversions or dollar-to-peso conversions. When the conversion spread becomes larger, consumer welfare is reduced. Higher spreads reflect greater monopoly power or fewer competitive pressures.

In contrast to the "informal," "underground," or "black market" currency enterprises that are found in many other Latin American metropolitan economies, the exchange bureaus of Ciudad Juarez are legally registered companies. Sell and buy price spreads are calculated for both sets of spot exchange rates included in the sample. The local sell–buy spreads are analyzed using border-crossings, exchange rate, and cross-border interest rate differentials. The results indicate that the bank spread and the kiosk spread respond very differently to changes in the explanatory variables. This indicates that, in spite of the pervasive nature of global currency market liquidity, regional economic factors also influence local exchange rates and bid-ask spreads.

Subsequent parts of the study are as follows. A brief overview of related literature is provided in the second section. A description of the data and methodology is next. Empirical results follow. A summary plus suggestions for future research comprise the conclusion.

LITERATURE REVIEW

Early research on regional exchange rates does not employ actual regional currency quotes (Hervey and Straus, 1998). Instead, this branch of the literature recognizes that, due to industrial and trade pattern differences, regional economies respond in fairly distinct manners to exchange rate fluctuations (Clark, Sawyer, and Sprinkle, 1999). Regional inflation differences may also contribute to the geographic variations in those responses. Given that, regional exchange rate indices are constructed in manners that take those differences into account as a means toward understanding economic performance variations across geographical areas within national economies (Ibarra, 1999). Because data from only one region are employed for this study, geographic inflationary differences will not affect the analysis.

Several studies have explored the menu prices of identical items sold by restaurant franchises in different regions to explore diversions between computed purchasing power parity (PPP) exchange rates and nominal exchange rates in different regions (Bojanic, Warnick, and Musante, 2007; Fullerton, Fierro, and Villalobos, 2009). Among other findings, border zone firms have been found to adjust prices more rapidly than firms in other regions when price ratios and exchange rates diverge.

A separate strand of this literature has used the prices of brand name medicines in different regions in order to explore gaps between nominal exchange rates and implied law of one price exchange rates (Quon, Firszt, and Eisenberg, 2005; Fullerton and Miranda, 2011; Fullerton, Pallares, and Walke, 2014). Those efforts yield a variety of interesting results. To date, however, there have been very few, if any, studies that examine the differences in exchange rate quotes and bid-ask spreads within individual border metropolitan economies.

This topic is important for border regions and may have implications for global finance in general. Sell-buy spreads tend to be substantial in foreign exchange markets throughout the world (Geromichalos and Jung, 2018). Border areas provide natural settings to garner more evidence on how currency market spreads fluctuate over time.

DATA AND METHODOLOGY

A daily newspaper, *El Diario de Juarez* (El Diario), reports exchange rate data for Ciudad Juarez. Data are collected from six exchange rate kiosks and six commercial banks located in Ciudad Juarez. El Diario has collected the data from the same exchange rate kiosks and banks from 2009 forward. El Diario reports the average buy (compra) and sell (venta) peso prices of dollars for the exchange rate kiosks and for the banks. Dollar sell prices are always higher than dollar buy prices at all twelve companies. Because currency services are not offered at commercial banks on weekends, the exchange rates are reported daily for Monday through Friday. Similar to Geromichalos and Jung (2018), data employed for this study are converted into monthly averages for January 2009 through June 2016, providing a sample size of n = 90.

Two dependent variables are calculated using the exchange rate data from El Diario. The first dependent variable is the spread (difference) between sell (venta) and buy (compra) prices offered to exchange rate kiosk customers in Ciudad Juarez. In Equation (1), KSP is the kiosk spread in pesos per dollar, KSELL is the sell price in pesos per dollar, KBUY is the purchase price in pesos per dollar, and t is a time period subscript for each month in the sample.

$$KSP_t = KSELL_t - KBUY_t \tag{1}$$

The second dependent variable is the spread between buy and sell prices offered by commercial banks to foreign exchange customers in Ciudad Juarez. In Equation (2), where BSP is the bank spread in pesos per dollar, BSELL is the commercial bank sell price in pesos per dollar, BBUY is the purchase price in pesos per dollar at commercial banks, and t is a time period subscript for each month in the sample. BSP is the difference between peso sell and peso buy prices of dollars offered to commercial bank clients in Ciudad Juarez.

$$BSP_t = BSELL_t - BBUY_t \qquad (2)$$

Two additional steps are taken before the dependent variables are employed for regression analysis. Large transactions that occur in international currency markets can affect local spreads. Given that, KSP and BSP are adjusted by subtracting the 48-hour peso per dollar interbank exchange rate spread calculated using data from Banco de Mexico (BM, 2016). This step is performed to reduce any undue influence that large international transactions from outside the region might have on the local sell-buy spreads.

Equation (3) shows how the interbank spread is calculated using the 48-hour peso per dollar interbank exchange rate quotes reported by Banco de Mexico (BM, 2016). In Equation (3), $ISPREAD_t$ is the interbank exchange rate spread in month $_t$, $ISELL_t$ is the 48-hour interbank sell price of dollars in month t, and $IBUY_t$ is the 48-hour interbank buy price of dollars in month t. That spread is then subtracted from the local kiosk and bank spreads to yield the adjusted spreads shown in Equations (4) and (5).

$$ISPREAD_t = ISELL_t - IBUY_t \qquad (3)$$

$$KSPREAD_t = KSELL_t - KBUY_t - ISPREAD_t = KSP_t - ISPREAD_t \qquad (4)$$

$$BSPREAD_t = BSELL_t - BBUY_t - ISPREAD_t = BSP_t - ISPREAD_t \qquad (5)$$

The data are also adjusted to eliminate monthly seasonal factors that affect exchange rate quotes and spreads at kiosks and commercial banks. Monthly seasonal indices are used to deseasonalize or eliminate the seasonal variation in the dependent variables. The indices are calculated using the seasonal index approach of Pindyck and Rubinfeld (1998). Both dependent variables are adjusted in order to eliminate seasonal influences that might affect exchange rate quotes and spreads in certain months more than others.

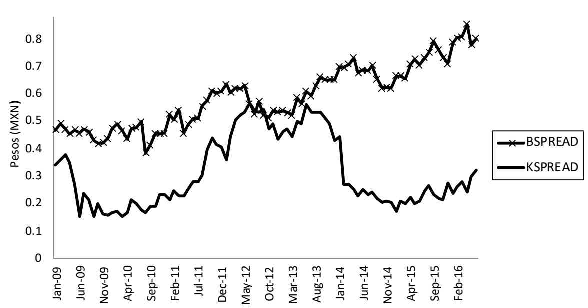

Figure 1. Commercial Bank and Kiosk Spreads (Pesos per Dollar)

Currency spreads are used rather than exchange rate averages because spreads provide information about potential gains or losses that kiosks and banks incur as a consequence of buying and selling pesos and dollars. Sell and buy spreads provide unique information on local exchange rates and currency market conditions. That is because spreads reflect the leeway that currency bureaus and commercial banks have for buying or selling dollars to local customers. Accordingly, exchange rate spreads provide insights to local border currency markets. For example, if dollar surpluses are accumulated, then sales prices are likely to be lowered, resulting in narrower spreads. Figure 1 illustrates the behavior of KSPREAD and BSPREAD during the sample period. The bank spreads are almost always higher than the kiosk spreads throughout the sample period. Because there are fewer barriers to entry facing currency bureaus, that pattern is not surprising and likely reflects greater levels of competition among the kiosks.

Table 1: Variable Names

Variable	Description	Units	Sources
BSPREAD	Commercial bank sell-buy dollar spread	Nominal Pesos	AC1
KSPREAD	Currency kiosk sell-buy dollar spread	Nominal Pesos	AC2
CROSS	Northbound border crossings into El Paso	Passengers	CBP
EXCJ	Average bank and kiosk exchange rate	Pesos per Dollar	AC3
RATEDIF	Mexico – USA yield difference	Percentage Points	AC4

Notes:
AC1 stands for author calculations using commercial bank exchange rate quotes for dollars as reported Monday through Friday each week in *El Diario de Juarez.*
AC2 stands for author calculations using currency kiosk exchange rate quotes for dollars as reported Monday through Friday each week in *El Diario de Juarez.*
CROSS stands for total northbound border crossings into El Paso by pedestrians, personal vehicle passengers, and bus passengers summarized in United States Customs & Border Protection monthly reports.
EXCJ stands for author calculations of the monthly nominal average peso per dollar exchange rate for all six commercial banks and all six currency kiosks reported Monday through Friday each week in *El Diario de Juarez.*
RATEDIF stands for author calculations of the monthly average nominal yield difference between 90-day Treasury Certificates in Mexico and 90-day Treasury Bills in the United States, 90-day CETES rate minus 90-day T-Bill rate.

Explanatory variables included in the sample are the total number of northbound border crossings from Ciudad Juarez into El Paso each month, the monthly average peso per dollar nominal exchange rate, and the monthly average nominal yield gap between 90-day Treasury Certificates in Mexico and 90-day Treasury Bills in the United States. Table 1 lists each of the sample variables. These data are housed within the Border Region Modeling Project section of The University of Texas at El Paso ScholarWorks (Fullerton and Pallares, 2021).

Summary statistics for the sample data are reported in Table 2. The commercial bank sell-buy spread sample mean is 58.6 centavos per dollar. In dollar terms, that is larger than the average spread reported for the dollar across five major currencies in Geromichalos and Jung (2018). The maximum bank spread of 85.0 centavos per dollar occurred in April 2016 during a heated United States presidential election campaign in which a major party candidate routinely disparaged the

North American Free Trade Agreement and argued that the government of Mexico should pay for a massive wall along the border of the two countries. The minimum bank spread of 38.1 centavos per dollar occurred in August 2010 as the United States economy was in the process of slowly emerging from the Great Recession.

Table 2: Summary Statistics

Statistic	BSPREAD	BSPREAD	CROSS	EXCJ	RATEDIF
Mean	0.5864	0.3101	2.1754	13.528	4.0097
Median	0.5863	0.2544	2.2367	12.988	4.1800
Std. Dev.	0.1141	0.1288	0.1984	1.5929	0.8636
Maximum	0.8502	0.5630	2.5829	18.158	7.5300
Minimum	0.3812	0.1498	1.8309	11.624	2.8400
Skewness	0.2744	0.6170	0.1984	1.5096	1.4931
Kurtosis	2.0475	1.8993	1.9265	4.3763	7.2227
CV	0.1946	0.4153	0.0912	0.1116	0.2403

Notes:

Sample period: January 2009 – June 2016.

CV stands for coefficient of variation.

Similar to Figure 1, Table 2 makes it easy to identify several differences between the bank and kiosk spreads. At 31.0 centavos per dollar, the average kiosk spread is substantially lower than that of the banks, but still higher than what is reported across the five bilateral exchange rates in Geromichalos and Jung (2018). The kiosk spread standard deviation of 12.9 centavos per dollar is roughly equal to that of the banks. The money office spreads are also more right-skewed than those of the banks. The coefficient of variation for the kiosks is also notably larger than that of the banks.

The larger bank and kiosk spreads probably indicate that the peso-dollar currency market in Ciudad Juarez is less liquid and less competitive than what collectively prevails for the dollar against the euro, the yen, the British pound, the Canadian dollar, and the Swiss franc. Direct arbitrage can occur whenever there are misalignments among the major bilateral exchange rates for the dollar. In Ciudad Juarez and El Paso, indirect arbitrage occurs via customer currency selection choices at retail stores whenever local price and exchange rate misalignments occur (Blanco-Gonzalez and Fullerton, 2006 ; Fullerton, Fierro, and Villalobos, 2009). Some currency service companies will physically visit exchange bureaus and banks to exploit sell-buy and/or exchange rate misalignments, but electronic arbitrage among the companies does not occur.

The sample average for the number of border crossers into El Paso is 2.175 million people per month. The sample maximum of nearly 2.583 million occurred in August 2009, while the minimum of approximately 1.831 million was tallied in February 2011. Relative to a Gaussian distribution, the monthly crossers data are platykurtic and fairly symmetric. Because of a small variance, these data also have a coefficient of variation that is below 0.10. Northbound border crossings are functionally related to several different regional and international economic variables (Fullerton and Solis, 2020).

As reported in Table 2, the sample average for the nominal exchange rate is 13.53 pesos per dollar. The maximum value of 18.16 happened in June 2016 during the United States presidential campaign when doubts were expressed regarding the economic wisdom of trade ties between the two countries. The minimum average currency quote of 11.62 was observed in July 2011, a month during which the peso was approximately 10 percent overvalued against the dollar (Fullerton et al., 2020). The exchange rate data are both right-skewed as well as leptokurtic. In spite of that, at 11.2, the coefficient of variation for this variable is fairly small.

The sample mean for the nominal yield difference is approximately 4.0 percentage points. The biggest monthly gap separating the 90-day CETES and the 90-day T-Bill rates is 7.5 percentage points. That arose in January 2009 during one of the low points of the banking sector crisis in the United States. The smallest cross-border yield difference of 2.8 percentage points occurred in September 2014 during a period of both financial and inflationary calm in both countries. The nominal rate difference data are positively skewed and sharply leptokurtic.

To examine the relationships between each of the sell-buy spread variables and the explanatory variables, a generalized least squares autoregressive-moving average (GLS ARMAX) estimator is employed (Greene, 2000). Because of non-stationarity, all of the data are differenced prior to estimation (chi-squared and unit root test results are available upon request). Cross correlation functions are employed to determine lag lengths for the various explanatory variables included in the equation specifications (Enders, 2010). Given the speed with which currency quotes change, minimal lag lengths are anticipated. The GLS ARMAX estimator is employed because of the flexibility it provides in handling different data generating processes. It has previously proven highly useful in examining other border economic phenomena (Niño et al., 2015; Fullerton and Solís, 2020).

EMPIRICAL RESULTS

Estimation results for the commercial bank spread are reported in Columns 2 and 3 of Table 3. There is an inverse relationship between the number of border crossers and the bank spread. Although it is not statistically reliable, that result potentially reflects increased liquidity that results when greater cross-boundary travel occurs (Cheung and Wong, 2000). A direct relationship exists between the exchange rate and the sell-buy gap. Every 1-peso increase in the exchange rate leads to a 3.7 centavo increment in the spread. A negative relationship is also documented for the 90-day government bill yield differential. A 1-percentage point increase in the cross-border yield gap is associated with a 1.5 centavo decrement in the bank sell-buy spread. The latter effect, however, is statistically unreliable.

The commercial bank spread equation specification does not successfully explain all variations in the dependent variable. Given that, a first order moving average term, MA(1), is required to correct for serial correlation in the residuals. The selection of the MA(1) term that appears in Table 3 is based upon residual autocorrelation function estimates of the original specification (Enders, 2010).

Inclusion of the MA(1) term is necessary to ensure that all coefficient standard deviation estimates are accurate.

Estimation results for the kiosk sell-buy spread are summarized in Columns 4 and 5 of Table 3. A negative relationship is also uncovered between the kiosk spread and the volume of monthly border crossers. For the currency office spread, however, the slope parameter satisfies the standard 5-percent significance criterion. Exchange rate fluctuation impacts are much smaller for the kiosk spread. Although statistically unreliable, a 1-peso increase in the currency value of the dollar translates into a 1-centavo increment in the kiosk sell-buy gap. While it does not satisfy the 5-percent criterion, a 1-percentage point upward movement in the cross-border yield gap leads to a 3.5 centavo increase in the kiosk spread. That is the opposite of the inverse correlation reported for that regressor in the bank spread equation. It is similar to bilateral currency exchange estimates reported by Davutyan (1997).

As in the case of the commercial bank equation, serial correlation is present in the kiosk residuals. The data generating process in this case, however, is first order autoregressive. Accordingly, an AR(1) term is included with the exchange bureau estimation results shown in Table 3. An autocorrelation function estimated for the residuals from the baseline specification also determined the selection of the AR(1) term. The negative coefficient implies mild overshooting behavior, a common feature of many currency markets (Wong, 2020).

The estimation results in Tables 3 contain several interesting outcomes. Both spreads are inversely correlated with the monthly volume of cross-border passenger traffic. Only the exchange bureau spread responds to variations in border traffic flows in a statistically reliable manner, and the magnitude of that reaction is much larger than what is at the commercial banks. Apparently, increased border commuting creates better currency conversion opportunities for kiosk customers relative to what occurs for bank clients. That may be due to greater relative competition among currency bureaus than among commercial banks since banking has substantial barriers to entry.

Table 3: Commercial Bank & Currency Kiosk Exchange Rate Spread Estimation Results

Dependent Variables: D(BSPREAD) and D(KSPREAD)
Method: ARMAX Generalized Least Squares (Gauss-Newton)
Raw Data Sample: January 2009 – June 2016, 89 Observations after Differencing
Convergence achieved after 12 iterations.
Coefficient covariance computed using outer product of gradients.
Degrees of freedom adjustment for standard errors and covariance matrix.

	Commercial Bank Spread		**Currency Kiosk Spread**	
Variable	**Coefficient**	**Computed t-Statistic**	**Coefficient**	**Computed t-Statistic**
Constant	0.001379	0.546602	0.000801	0.209616
D(CROSS)	-0.006426	-0.158547	-0.11362	-2.54774
D(EXCJ)	0.036526	3.644545	0.009701	-2.54774
D(RATEDIF)	-0.015083	-0.956820	0.034919	1.607805
MA(1)	-0.286321	-2.707678		
AR(1)			-0.168397	-1.556860
R-Squared		0.197323		0.113085
Adjusted R-Sq.		0.159100		0.070851
Std. Err. of Reg.		0.030852		0.039644
Pseudo R-Squared		0.896669		0.882029
Inverted MA Roots		0.29		
Inverted AR Roots				-0.17
Dep. Var. Mean		0.003737		-0.000185
Dep. Var. Std. Dev.		0.033645		0.041128
Hannan Quinn Inf. Crit.		-4.007353		-3.506541
Log Likelihood Stat.		185.8349		163.5488
Computed F-Statistic		5.162445		2.677584
Probability (F-Stat.)		0.000909		0.037211
JB Normality Chi-Sq. Stat.		14.26063		83.59537
Probability (JB Chi-Sq.)		0.0008		0.0000
BG Serial Correl. F-Stat.		0.467759		0.593549
Probability (BG F-Stat.)		0.6281		0.5553

Notes:
D is a first difference operator.
For coefficient readability, CROSS is divided by 1 million prior to estimation.
MA(1) stands for moving average coefficient at lag 1.
AR(1) stands for autoregressive coefficient at lag 1.
Pseudo R-Squared is the square of the correlation coefficient between the actual and fitted dependent variable in levels.
BG Serial Correl. F-Stat. is the computed F-Statistic for a Breusch-Godfrey Lagrange Multiplier test of a null

hypothesis of no serial correlation (failure to reject implies that the residuals are independently distributed and not autocorrelated).
BPG Heterosced. F-Stat. is the computed F-Statistic for a Breusch-Pagan-Godfrey Lagrange Multiplier test of a null hypothesis of homoscedasticity (failure to reject implies that the residuals are homoscedastic).

Overall liquidity probably increases with greater magnitudes of cross-border travel as it allows visitors to access more currency exchange operations. Currency value impacts on border commuting have been previously documented (Fullerton, 2000; Fullerton and Solís, 2020). This is the first time, however, that lower peso per dollar sell-buy spreads have been quantified as consequences of increased border traffic flows. The converse also holds for cases when decreases in the volumes of border traffic flows are observed.

A reverse set of circumstances is observed for fluctuations in the currency market value of the peso versus the dollar. The commercial bank spread is positively correlated with the peso-dollar exchange rate. That relationship is statistically reliable. For the exchange bureaus, a direct correlation is also observed, but the magnitude of that association is much smaller and does not meet the 5-percent significance criterion. Currency market quotes are, thus, seen to exercise more predictable effects on commercial bank spreads than what occurs at the kiosks.

Treasury yield differentials between Mexico and the United States lead to opposite reactions in the two spreads. At the banks, an increase in the gap between 90-day Treasury certificate rates of return leads to a decline in the sell-buy exchange rate difference. The converse occurs at the exchange houses, with currency spreads increasing when 3-month yields rise in Mexico relative to those on the north side of the border. The latter effect is more reliable than what it is for the banks, but also fails to satisfy the standard significance benchmark.

Most of the parameter estimates in Table 3 fail to surpass the standard 5-percent significance criterion. The magnitudes of the coefficients are, however, economically plausible. That is an important characteristic to consider, especially for a data sample where the dependent variables are fairly stationary, as shown in Figure 1 (McCloskey and Ziliak, 1996). If a larger sample size becomes available for follow-up research, it is likely that slope coefficient standard errors will be smaller. Even in cases of larger sample sizes and more attractive statistical diagnostic metrics, parameter sizes and economic plausibility should still be taken into account (Ziliak and McCloskey, 2004).

In spite of some low regression parameter computed t-statistics, the overall characteristics of the equations reported in Table 3 are fairly good. The pseudo R-squared statistics for both equations exceed 88 percent. Lagrange multiplier tests also indicate that the residuals for both equations are well behaved, exhibiting neither serial correlation nor heteroscedasticity.

It should be noted, however, that Chi-squared tests indicate that the residuals for both equations do not follow Gaussian distributions. In both cases, the residuals are leptokurtic. In other words, both sets of residuals are more fat-tailed than that of a normal distribution. That implies that sell-buy spreads in the Ciudad Juarez regional currency market may be subject to unexpectedly abrupt movements (Ibragimov et al., 2013). For a thinly traded market that possibility is certainly plausible. More studies with larger sample sizes are required to conclusively determine if that is true.

CONCLUSION

Historically, little research has been conducted for regional exchange rate spreads. This study employs data for a northern Mexico metropolitan economy located along the border with the United States. The data sample includes sell-buy spreads for both commercial banks and currency kiosks.

On average, both spreads in this sample are larger than those associated with major currency bilateral exchange rates for the dollar. That likely results from greater market liquidity and more efficiency in major currency markets than what exists in Ciudad Juarez where arbitrage pressures tend to be indirect and exchange transactions are mostly non-electronic. Econometric outcomes for the two spreads differ substantially with, kiosk spreads responding more to border commuting changes, and bank spreads reacting more noticeably to currency market fluctuations. For government yield differentials, the reactions are in opposite directions for the two types of businesses.

Whether those results are unique to the currency market in Ciudad Juarez is unknown at this point. Follow-up studies for other regions would be helpful. In Mexico, logical geographic candidates include Tijuana, Nogales, Nuevo Laredo, Reynosa, and Matamoros. The outcomes reported in this study indicate that regional peso-dollar sell-buy spreads follow non-random patterns that can be modeled using standard econometric methods. Whether this is unique to Ciudad Juarez remains to be determined.

REFERENCES

Baharumshah, A.Z., S.H. Mohd, and S.V. Soon, S.V. 2011. "Purchasing Power Parity and Efficiency of Black Market Exchange Rate in African Countries." Emerging Markets Finance & Trade 47 (5):52-70.

Bahmani-Oskooee, M., S.W. Hegerty, and A. Tanku. 2010. "The Black-Market Exchange Rate versus the Official Rate: Which Rate Fosters the Adjustment Speed in the Monetarist Model?" Manchester School 78 (5):725-738.

Blanco-Gonzalez, L., and T.M. Fullerton, Jr. 2006. "Borderplex Menu Evidence for the Law of One Price." Economics Letters 90 (1):28-33.

BM. 2016. Sistema de Información Económica. México, DF: Banco de México.

Bojanic, D., R. Warnick, and M. Musante. 2007. "An Extention of Burgernomics: Using a Full-Service Restaurant to Measure Purchasing Power Parity." Journal of Hospitality Financial Management, 15 (1):Article 6.

Cheung, Y.W., and C.Y.P. Wong. 2000. "A Survey of Market Practitioners' Views on Exchange Rate Dynamics." Journal of International Economics 51 (2):401-419.

Clark, D.P., W.C. Sawyer, and R.L. Sprinkle. 1999. "Regional Exchange Rate Indexes for the United States." Journal of Regional Science 39 (1):149-166.

Davutyan, N. 1997. "The Bid-Ask Spread for Dollars in Kuwait." Applied Economics Letters 4 (11):715-717.

Enders, W. 2010. Applied Econometric Time Series. Hoboken, NJ: John Wiley & Sons.

Fullerton, T.M., Jr. 2000. "Currency Movements and International Border Crossings." International Journal of Public Administration 23 (5-8):1113-1123.

Fullerton, T.M., Jr., and R. Coronado. 2001. "Restaurant Prices and the Mexican Peso." Southern Economic Journal 68 (1):145-155.

Fullerton, T.M., Jr., K.P. Fierro, and E. Villalobos. 2009. "Cross-Border Restaurant Price and Exchange Rate Interactions." North American Journal of Economics & Finance 20 (3):281-288.

Fullerton, T.M., Jr., and O. Miranda. 2011. "Borderplex Brand Name Medicine Price Differences." Applied Economics 43 (8):929-939.

Fullerton, T.M., Jr., and A.V. Mollick. 2013. "Border Region Panel Evidence on PPP Deviations." Applied Economics 45 (16):2175-2182, doi: 10.1080/00036846.2012.654919.

Fullerton, T. M., Jr., and F.J. Pallares. 2021. Bank and Kiosk Currency Spread Data Set. El Paso, TX: University of Texas at El Paso Border Region Modeling Project.

Fullerton, T. M., Jr., F.J. Pallares, and A.G. Walke. 2014. "Are Online Pharmacy Prices Really Lower in Mexico?" Asian Economic & Financial Review 4 (4):416-434.

Fullerton, T.M., Jr., S.L. Fullerton, A.P. Gutierrez-Zubiate, and I. Santana-Ramirez. 2020. "Covid-19 Business Cycle Convulsions." Borderplex Business Barometer 4 (11):1-58.

Fullerton, Jr., T.M., and O. Solis. 2020. "Borderplex Bridge Wait Time Headache Reactions." Journal of Transport Economics & Policy 54 (1):58-78.

Gabaix, X., and M. Maggiori. 2015. "International Liquidity and Exchange Rate Dynamics." Quarterly Journal of Economics 130 (3):1369-1420.

Galstyan, V., and A. Velic. 2017. "Debt Thresholds and Real Exchange Rates: An Emerging Markets Perspective." Journal of International Money and Finance 70:452-470.

Geromichalos, A., and K.M. Jung. 2018. "An Over-the-Counter Approach to the FOREX Market." International Economic Review 59 (2):859-905, doi: 10.1111/iere.12290.

Greene, W.H. 2000. Econometric Analysis. Upper Saddle River, NJ: Prentice Hall.

Hervey, J.L., and W.A. Strauss. 1998. "A Regional Export-Weighted Dollar: An Examination of the Regional Impact of Exchange Rate Change." International Regional Science Review 21 (1):79-98.

Ibarra, A. 1999. Índice Encadenado de la Tasa de Cambio Real Regional Ponderado por el Comercio de Exportación. Bogotá, CO: Banco de la República Subgerencia de Estudios Económicos.

Ibragimov, M., R. Ibragimov, and P. Kattuman. 2013. "Emerging Markets and Heavy Tails." Journal of Banking & Finance 37 (7):2546-2559.

McCloskey, D.N., and S.T. Ziliak. 1996. "The Standard Error of Regression." Journal of Economic Literature 34 (1):97-114.

Niño, P., R. Coronado, T.M. Fullerton, Jr., and A.G. Walke. 2015. "Cross-Border Homicide Impacts on Economic Activity in El Paso." Empirical Economics 49 (4):1543-1559, doi: 10.1007/s00181-015-0924-0.

Papell, D.H. 2006. "The Panel Purchasing Power Parity Puzzle." Journal of Money, Credit & Banking 38 (2):447-467.

Pindyck, R.S., and D.L. Rubinfeld. 1998. Econometric Models and Economic Forecasts. New York, NY: Irwin McGraw-Hill.

Wong, D.K.T. 2020. "A Re-examination of the Impacts of Macroeconomic and Financial Shocks on Real Exchange Rate Fluctuations." Applied Economics 52 (50):5491-5515, doi: 10.1080/00036846.2020.1765962.

Ziliak, S.T., and D.N. McCloskey. 2004. "Size Matters." Econ Journal Watch 1 (2):331-358.

The University of Texas at El Paso

Announces

Borderplex Historical Data to 2018

UTEP is pleased to announce the 2020 edition of its primary source of Borderplex long-term historical economic information. Topics covered include demography, employment, personal income, retail sales, residential real estate, transportation, international commerce, and municipal water consumption. These data comprise the backbone of the UTEP Border Region Econometric Model developed under the auspices of a corporate research gift from El Paso Electric Company and maintained using externally funded research support from El Paso Water and Hunt Communities.

The authors of this publication are UTEP Professor & Trade in the Americas Chair Tom Fullerton and UTEP Border Region Modeling Project Associate Director & Economist Steven Fullerton. Dr. Fullerton holds degrees from UTEP, Iowa State University, Wharton School of Finance at the University of Pennsylvania, and University of Florida. Prior experience includes positions as Economist in the Executive Office of the Governor of Idaho, International Economist in the Latin America Service of Wharton Econometrics, and Senior Economist at the Bureau of Economic and Business Research at the University of Florida. Steven Fullerton has published research on Major League Baseball, the National Football League, and housing price fluctuations in Las Cruces.

The border long-range historical data reference can be purchased for $20 per copy. Please indicate to what address the report(s) should be mailed (also include telephone, fax, and email address):

____

____

____

____

____

____

Send checks made out to The University of Texas at El Paso for $20 to:

Border Region Modeling Project - CBA 236
UTEP Department of Economics & Finance
500 West University Avenue
El Paso, TX 79968-0543

Online orders can be placed via:
https://secure.touchnet.net/C21711_ustores/web/product_detail.jsp?PRODUCTID=800

Request information from 915-747-7775 or
slfullerton@utep.edu if payment in pesos is preferred.

The University of Texas at El Paso

Announces

Borderplex Long-Term Economic Trends to 2049

UTEP is pleased to announce the 2020 edition of its primary source of long-term structural trend border economic information. Topics covered include demography, employment, personal income, retail sales, residential real estate, transportation, international commerce, and municipal water consumption. Forecasts are generated utilizing the 250-equation UTEP Border Region Econometric Model developed under the auspices of a corporate research gift from El Paso Electric Company and maintained using externally funded research support from El Paso Water and Hunt Communities.

The authors of this publication are UTEP Professor & Trade in the Americas Chair Tom Fullerton and UTEP Border Region Modeling Project Associate Director & Economist Steven Fullerton. Dr. Fullerton holds degrees from UTEP, Iowa State University, Wharton School of Finance at the University of Pennsylvania, and University of Florida. Prior experience includes positions as Economist in the Executive Office of the Governor of Idaho, International Economist in the Latin America Service of Wharton Econometrics, and Senior Economist at the Bureau of Economic and Business Research at the University of Florida. Steven Fullerton has published research on Major League Baseball, the National Football League, and housing price fluctuations in Las Cruces.

The border long-range outlook through 2049 can be purchased for $25 per copy. Please indicate to what address the report(s) should be mailed (also include telephone, fax, and email address):

____
____
____
____
____
____

Send checks made out to The University of Texas at El Paso for $25 to:

Border Region Modeling Project - CBA 236
UTEP Department of Economics & Finance
500 West University Avenue
El Paso, TX 79968-0543

Online orders can be placed via:
https://secure.touchnet.net/C21711_ustores/web/product_detail.jsp?PRODUCTID=810

Request information from 915-747-7775 or
slfullerton@utep.edu if payment in pesos is preferred.

The UTEP Border Region Modeling Project & UACJ Press

Announce the Availability of

Basic Border Econometrics

The University of Texas at El Paso Border Region Modeling Project is pleased to announce **Basic Border Econometrics**, a publication from Universidad Autónoma de Ciudad Juárez. Editors of this new collection are Martha Patricia Barraza de Anda of the Department of Economics at Universidad Autónoma de Ciudad Juárez and Tom Fullerton of the Department of Economics & Finance at The University of Texas at El Paso.

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.

Border economics is a field in which many contradictory claims are often voiced, but careful empirical documentation is rarely attempted. **Basic Border Econometrics** is a unique collection of ten separate studies that empirically assess carefully assembled data and econometric evidence for a variety of different topics. Among the latter are peso fluctuations and cross-border retail impacts, border crime and boundary enforcement, educational attainment and border income performance, pre- and post-NAFTA retail patterns, self-employed Mexican-American earnings, maquiladora employment patterns, merchandise trade flows, and Texas border business cycles.

Contributors to the book include economic researchers from The University of Texas at El Paso, New Mexico State University, University of Texas Pan American, Texas A&M International University, El Colegio de la Frontera Norte, and the Federal Reserve Bank of Dallas. Their research interests cover a wide range of fields and provide multi-faceted angles from which to examine border economic trends and issues.

A limited number of **Basic Border Econometrics** can be purchased for $15 per copy. Please contact Professor Servando Pineda of Universidad Autónoma de Ciudad Juárez at spineda@uacj.mx to order copies of the book. Additional information for placing orders is also available from Professor Martha Patricia Barraza de Anda at mbarraza@uacj.mx.

The University of Texas at El Paso Technical Report Series:

TX97-1: *Currency Movements and International Border Crossings*
TX97-2: *New Directions in Latin American Macroeconometrics*
TX97-3: *Multimodal Approaches to Land Use Planning*
TX97-4: *Empirical Models for Secondary Market Debt Prices*
TX97-5: *Latin American Progress under Structural Reform*
TX97-6: *Functional Form for United States-Mexico Trade Equations*
TX98-1: *Border Region Commercial Electricity Demand*
TX98-2: *Currency Devaluation and Cross-Border Competition*
TX98-3: *Logistics Strategy and Performance in a Cross-Border Environment*
TX99-1: *Inflationary Pressure Determinants in Mexico*
TX99-2: *Latin American Trade Elasticities*
CSWHT00-1: *Tariff Elimination Staging Categories and NAFTA*
TX00-1: *Borderplex Business Forecasting Analysis*
TX01-1: *Menu Prices and the Peso*
TX01-2: *Education and Border Income Performance*
TX02-1: *Regional Econometric Assessment of Borderplex Water Consumption*
TX02-2: *Empirical Evidence on the El Paso Property Tax Abatement Program*
TX03-1: *Security Measures, Public Policy, Immigration, and Trade with Mexico*
TX03-2: *Recent Trends in Border Economic Analysis*
TX04-1: *El Paso Customs District Cross-Border Trade Flows*
TX04-2: *Borderplex Bridge and Air Econometric Forecast Accuracy: 1998-2003*
TX05-1: *Short-Term Water Consumption Patterns in El Paso*
TX05-2: *Menu Price and Peso Interactions: 1997-2002*
TX06-1: *Water Transfer Policies in El Paso*
TX06-2: *Short-Term Water Consumption Patterns in Ciudad Juárez*
TX07-1: *El Paso Retail Forecast Accuracy*
TX07-2: *Borderplex Population and Migration Modeling*
TX08-1: *Borderplex 9/11 Economic Impacts*
TX08-2: *El Paso Real Estate Forecast Accuracy: 1998-2003*
TX09-1: *Tolls, Exchange Rates, and Borderplex Bridge Traffic*
TX09-2: *Menu Price and Peso Interactions: 1997-2008*
TX10-1: *Are Brand Name Medicine Prices Really Lower in Ciudad Juárez?*
TX10-2: *Border Metropolitan Water Forecast Accuracy*
TX11-1: *Cross Border Business Cycle Impacts on El Paso Housing: 1970-2003*
TX11-2: *Retail Peso Exchange Rate Discounts and Premia in El Paso*
TX12-1: *Borderplex Panel Evidence on Restaurant Price and Exchange Rate Dynamics*
TX12-2: *Dinámica del Consumo de Gasolina en Ciudad Juárez: 2001-2009*
TX13-1: *Physical Infrastructure and Economic Growth in El Paso: 1976-2009*
TX13-2: *Tolls, Exchange Rates, and Northbound International Bridge Traffic: 1990-2006*
TX14-1: *Freight Transportation Costs and the Thickening of the U.S.-Mexico Border*
TX14-2: *Are Online Pharmacy Prices Really Lower in Mexico?*
TX15-1: *Drug Violence, the Peso, and Northern Border Retail Activity in Mexico*
TX15-2: *Downtown Parking Meter Demand in El Paso*
TX16-1: *North Borderplex Retail Gasoline Price Fluctuations: 2000-2013*
TX16-2: *Residential Electricity Demand in El Paso: 1977-2014*
TX17-1: *Southern Border Recession Predictability in the United States: 1990-2015*
TX17-2: *Collegiate Football Attendance in El Paso: 1967-2014*
TX18-1: *Infrastructure Impacts on Commercial Property Values across El Paso in 2013*
TX18-2: *Electricity Consumption and Economic Growth in El Paso: 1976-2015*
TX19-1: *Hotel Sector Forecast Accuracy in El Paso: 2006-2016*
TX19-2: *Southern Border International Shopping and Employment: 1990-2016*
TX20-1: *Borderplex Bridge Delay Headaches: 2010-2016*
TX20-2: *Las Cruces Housing Price Fluctuations: 1971-2017*
TX21-1: *Trade Clusters and USA Southern Border Transportation Costs: 1995-2015*
TX21-2: *Ciudad Juarez Exchange Rate Sell-Buy Spreads: 2009-2016*

The University of Texas at El Paso Border Business Forecast Series:

SR98-1: *El Paso Economic Outlook: 1998-2000*
SR99-1: *Borderplex Economic Outlook: 1999-2001*
SR00-1: *Borderplex Economic Outlook: 2000-2002*
SR01-1: *Borderplex Long-Term Economic Trends to 2020*
SR01-2: *Borderplex Economic Outlook: 2001-2003*
SR02-1: *Borderplex Long-Term Economic Trends to 2021*
SR02-2: *Borderplex Economic Outlook: 2002-2004*
SR03-1: *Borderplex Long-Term Economic Trends to 2022*
SR03-2: *Borderplex Economic Outlook: 2003-2005*
SR04-1: *Borderplex Long-Term Economic Trends to 2023*
SR04-2: *Borderplex Economic Outlook: 2004-2006*
SR05-1: *Borderplex Long-Term Economic Trends to 2024*
SR05-2: *Borderplex Economic Outlook: 2005-2007*
SR06-1: *Borderplex Long-Term Economic Trends to 2025*
SR06-2: *Borderplex Economic Outlook: 2006-2008*
SR07-1: *Borderplex Long-Term Economic Trends to 2026*
SR07-2: *Borderplex Economic Outlook: 2007-2009*
SR08-1: *Borderplex Long-Term Economic Trends to 2027*
SR08-2: *Borderplex Economic Outlook: 2008-2010*
SR09-1: *Borderplex Long-Term Economic Trends to 2028*
SR09-2: *Borderplex Economic Outlook: 2009-2011*
SR10-1: *Borderplex Long-Term Economic Trends to 2029*
SR10-2: *Borderplex Economic Outlook: 2010-2012*
SR11-1: *Borderplex Economic Outlook: 2011-2013*
SR12-1: *Borderplex Economic Outlook: 2012-2014*
SR13-1: *Borderplex Economic Outlook: 2013-2015*
SR14-1: *Borderplex Economic Outlook to 2016*
SR15-1: *Borderplex Economic Outlook to 2017*
SR16-1: *Borderplex Economic Outlook to 2018*
SR17-1: *Borderplex Economic Outlook to 2019*
SR18-1: *Borderplex Economic Outlook to 2020*
SR19-1: *Borderplex Economic Outlook to 2021*
SR20-1: *Borderplex Historical Data to 2018*
SR20-2: *Borderplex Long-Term Economic Trends to 2049*
SR21-1: *Borderplex Economic Outlook to 2022*

Most Border Region Modeling Project Technical Reports and Borderplex Economic Outlook Reports, can be downloaded for free from The University of Texas at El Paso Library:
https://scholarworks.utep.edu/border_region/

Technical Report TX21-2 is a publication of the Border Region Modeling Project and the Department of Economics & Finance at The University of Texas at El Paso. For additional **Border Region** information, please visit the www.academics.utep.edu/border section of the UTEP web site.

Border Region Modeling Project – CBA 236
UTEP Department of Economics & Finance
500 West University Avenue
El Paso, TX 79968-0543

utep.edu