3-2014

Are Online Pharmacy Prices Really Lower in Mexico?

Thomas M. Fullerton Jr.
University of Texas at El Paso, tomf@utep.edu

Adam G. Walke
University of Texas at El Paso, agwalke@utep.edu

Comments:
UTEP Border Region Modeling Project
Technical Report TX14-2
A revised version of this study is forthcoming in *Asian Economic & Financial Review*.

The University of Texas at El Paso
UTEP Border Region
Modeling Project

Technical Report TX14-2

Are Online Pharmacy Prices Really Lower in Mexico?

Produced by University Communications, March 2014

The University of Texas at El Paso

Are Online Pharmacy Prices Really Lower in Mexico?

Technical Report TX14-2
UTEP Border Region Modeling Project

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.academics.utep.edu/border 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:

Hunt Communities
El Paso Water Utilities
Universidad Autónoma de Ciudad Juárez
UTEP College of Business Administration
UTEP Department of Economics & Finance
City of El Paso Office of Management & Budget
UACJ Instituto de Ciencias Sociales y Administración
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 Utilities, Hunt Communities, 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.

Are Online Pharmacy Prices Really Lower in Mexico?*

Thomas M. Fullerton, Jr.
Francisco J. Pallares
Adam G. Walke
Department of Economics & Finance
University of Texas at El Paso
El Paso, TX 79968-0543
Telephone 915-747-7747
Facsimile 915-747-6282
Email tomf@utep.edu

*A revised version of this study is forthcoming in *Asian Economic & Financial Review.*

Abstract

Empirical research on international pharmaceutical prices has uncovered numerous interesting commonalities and differences across international markets. This study examines price differences for brand name medicines sold over the Internet in the United States and Mexico. Web sites in both countries advertise their services in English and price their products in dollars. Sample data for 50 top selling medicines are from October 2011 for equal dosages on a per unit basis, exclusive of shipping fees, handling charges, and taxes. For a few medicines, the savings available to consumers who purchase them from companies in Mexico are very large. For most medicines in the sample, the savings are comparable to those available from Internet sources in other countries. Non-parametric test results indicate that the price differences are statistically significant.

Keywords
Brand Name Medicines, Online Pharmacies, Price Differences, Applied Economics

JEL Category:
I11, Health Markets; M21, Business Economics; P52, Comparative Studies.

Acknowledgements

Financial support for this research was provided by El Paso Water Utilities, Hunt Companies of El Paso, Hunt Communities, Texas Department of Transportation, JPMorgan Chase Bank of El Paso, a UTEP College of Business Administration Faculty Research Grant, and the James Foundation Scholarship Fund. Helpful comments and suggestions were provided by Nathan Ashby and Tony Payan. Econometric research assistance was provided by Carlos Morales.

Introduction

In 2010, United States consumers spent close to $274 billion on pharmaceutical and other medical products (Christopher et al., 2011). Many consumers, understandably, search for savings when purchasing medicine. It is commonly believed that Internet prescription medications from Mexican pharmacies are less expensive than those sold at drug stores in the United States, but relatively little evidence documents the purported price differentials. The potential for consumer savings created by the price differences between countries is limited by United States legislation that restricts overseas online purchases to a maximum of 90-day supplies per customer for personal use (CBP, 2011). Mexican online pharmacies benefit by being able to sell medicines, subject to the 90-day supply limits, to consumers in the United States via mail orders.

This study compares online pharmacy prices for Mexico and the United States. The principal objective is to quantify whether Mexican online pharmacies truly offer lower prices to United States consumers. Recent research indicates that, contrary to popular opinion, not all medicine prices are lower in Mexico (Fullerton and Miranda, 2011). Given that, the formal null hypothesis tested is that the unit price of an online prescription drug purchased in Mexico is equal to the Internet unit price of the same medicine ordered in the United States. The data utilized for this test are prices for fifty brand name retail medicines. These prices were collected on 12 October 2011 from medsmex.com, pharmaciesherbal.com, and bajapharmacy.com in Mexico, and from familymeds.com and drugstore.com in the United States.

The second section of this paper contains a literature review. Data and methodology are discussed in the third section. The fourth section summarizes the empirical results. Concluding remarks and suggestions for further research are included in the fifth section.

Literature Review

Most of the research on cross-border sales of Mexican pharmaceuticals focuses on "brick-and-mortar" or "walk-in" pharmacies that cater to medical tourists. Survey evidence indicates that the primary reason for crossing the border to purchase medicine is customers' perception that prices are lower in Mexico (de Guzman et al., 2007; Byrd and Law, 2009). Given the important role of relative prices among the various factors influencing the decision to buy medications across the border, it is interesting to ask what percentage of cross-border pharmaceutical shoppers is insured. Calvillo and Lal (2003) find that 81 percent of United States residents purchasing medications at a pharmacy in the border town of Nuevo Progreso, Mexico, have health insurance. Similarly, Saatsoglou (2004) reports that 62 percent of United States residents who purchase drugs abroad have prescription drug coverage. Customers may opt to purchase medications in another country even when they have insurance if copayments or annual deductibles are high and international price differences are large.

Medicine price differences between the United States and other countries have received increasing attention in recent years. One branch of the literature on this subject attempts to quantify international price differences, while a second branch attempts to document why those differences exist. Addressing the latter question, Ridley (2005) argues that the prescription drug market meets the three conditions for differential pricing or price discrimination. First, sellers usually have some degree of market power derived from patents or copyrights. Second, some consumers are willing to pay more than others for the same product. Danzon and Furukawa (2003) note that pharmaceutical prices in developed countries closely correlate with income levels, which condition consumers' ability and willingness to pay. Finally, differential pricing requires restrictions on arbitrage. Wagner and McCarthy (2004) note that international arbitrage in pharmaceutical markets is often limited by government-imposed licensing requirements.

While price discrimination may account for some portion of cross-country price differentials, government intervention in the price-setting process also plays a role. Some countries impose stringent cost controls on drugs sold within their borders (APC, 2001). Kanavos and Vandoros (2011) find that differences in the extent of government intervention in the price-setting process are associated with variations in pharmaceutical prices across countries. In a study of seven developed nations, Danzon and Chao (2000) find that, while countries with stricter regulatory regimes often have lower prices for certain types of medicine, drug prices in those countries are also less likely to decline as a result of competition between pharmaceutical producers. Manning (1997) documents that differences in legal systems and product liability laws between the United States and Canada account for at least some of the observed medicine price differentials between those countries.

Another branch of the literature attempts to quantify medicine price differences between the United States and other countries. Quon et al. (2005) find that customers can save approximately 24 percent per unit by purchasing medications from Canadian Internet pharmacies compared to major online United States drug stores. Only three medications are found to be more expensive in Canada. Similar results reported by Fullerton and Miranda (2011) indicate that medicine purchases at "walk-in" pharmacies in Ciudad Juarez, Mexico also permit consumer savings. The latter effort also reports evidence that not all medicines are more expensive in El Paso pharmacies. The objective of this study is to contribute to this strand of the literature by quantifying online pharmacy price differentials between Mexico and the United States.

Data and Methodology

The sample is comprised by the top-selling name brand medicines in the United States in 2010, as listed by the website drugs.com. Of those medications with the largest sales, the ones that are available for both the United States and Mexico are included in the sample. Prior research on medicine price differences, particularly Quon et al. (2005), also employs brand name medicines that constitute large shares of the medicine market at particular points in time. The sample utilized in this effort follows that approach. Each medication included in the sample had annual sales volumes of $474 million or more in 2010 and the 50 medicines in the sample collectively account for a large share of the pharmaceutical market in the United States.

Generic medications are excluded from this study. Danzon and Furukawa (2003) indicate that generic medications have lower prices in the United States than in Chile, France, Germany, Italy, Japan, Mexico, and the United Kingdom. Generic drug sales represent only 27 percent of total medicine sales in United States (IMS, 2012). Because of this, the exclusion of these medications should not affect the accuracy of the results obtained using online pharmacy prices for brand name pharmaceuticals.

Price data collected are Internet pharmacy quotes for the United States and Mexico. In selecting sources of online drug prices it is important to consider the reputability of each site. Rabinovitch (2005) contends that, while many online cross-border pharmacies are legitimate, "rogue" online pharmacies also exist and the products marketed through such sites are more likely to be sub-standard or even hazardous to consumer health. Online sources of drug prices are therefore evaluated to screen out potential rogue pharmacies, such as those that primarily market recreational and lifestyle drugs. The pricing information is retrieved from two online pharmacies with headquarters in the United States (drugstore.com and familymeds.com) and three online pharmacies with headquarters located in Mexico (bajapharmacy.com, pharmaciesherbal.com, and medsmex.com).

The drugstore.com site lists most of the medicines in the sample. The only exceptions are: Lantus SoloSTAR, Seroquel XR, Premarin and Ventolin HFA. Prices for these medicines are retrieved from familymeds.com to complete the sample. In Mexico, the online pharmacy site bajapharmacy.com is employed because it also advertises most of the medicines. The webpage for that site is in English and its prices are quoted in United States dollars. Prices for several medicines must be obtained from medsmex.com or pharmaciesherbal.com: Spiriva, Lantus, Diovan HCT, Viagra, Atripla, Lantus SoloSTAR, Nasonex, Truvada, Niaspan, Cialis, Namenda, Symbicort, Detrol LA, Benicar, Gleevec, Synthroid, Xalatan, Premarin, Ventolin HFA, Restasis and Femara. Both medsmex.com and pharmaciesherbal.com also list the names of drugs in English and display prices in United States dollars.

Prices for all medicines in the sample are collected for 12 October 2011. The online prices collected are those seen by the consumer. Shipping fees are excluded because of the minimal effect that these

fees typically contribute to total purchase prices (Quon et al., 2005). The prices utilized also exclude taxes, since most states in the United States do not levy sales taxes on medications or Internet sales, while in Mexico the sale of medicines is tax exempt. The number of pills per package generally varies between the United States and Mexico for each product. The price comparison is carried out by obtaining the unit price of the medicines as listed for the consumer. Unit prices are calculated by dividing the total price of a package by the number of units contained. Statistical moments are then calculated for the prices and price differences. Skewness and kurtosis estimates are used for normality testing (Bera and Jarque, 1981). Dosage strengths are kept the same for each unit price pair.

The formal null hypothesis shown in Equation (1) is that the difference between the unit online prices of the medicines in United States and Mexico is equal to zero. The alternative hypothesis is that the difference between online unit prices of medicines charged in the United States and Mexico is different from zero. Although incomes are higher in the United States, recent research conducted using prices for prescription medications sold in brick and mortar pharmacies shows that prices are sometimes higher in Mexico (Fullerton and Miranda, 2011).

$$H_0: P_{USA} - P_{MEX} = 0 \quad \text{vs.}$$
$$H_A: P_{USA} - P_{MEX} \neq 0 \qquad (1)$$

In order to formally test the null hypothesis, both parametric and non-parametric statistical tests are utilized. The t-test assumes a normal distribution. With only 50 observations in the sample, that may not be a safe assumption. Cross-border price data have been previously shown to not follow normal distributions due in part to kurtosis resulting from heavy histogram tails (Fullerton and Coronado, 2001). Given that, a signed ranks test that makes no assumptions regarding the distribution of the data is also employed (Wilcoxon, 1945).

Empirical Results

Summary statistics for the data are shown in Table 1. The average unit price for medicines sold online in the United States is $23.48 while it is $18.62 for those sold in Mexico. As in prior studies (Quon et al., 2005; Fullerton and Miranda, 2011), not all of the United States prices exceed their international counterparts. Forty of the fifty medications included in the sample, however, are less expensive when purchased from the online pharmacies located south of the border. Possible explanations of why these medicines are less expensive in Mexico include differences in income levels, regulatory controls, and product liability risks (Manning, 1997; Ridley, 2005; Kanavos and Vandoros, 2011). The limited opportunities for pharmaceutical trade between Mexico and the United States, along with potential risks of product losses or damages associated with cross-border medicine purchases, may contribute to maintaining price differentials between the two countries.

Because the Mexican Internet pharmacy sites are published in English and prices are quoted in dollars, these pharmacies are likely oriented towards the United States market. It is possible that pharmaceutical prices offered to Mexican consumers are lower than those advertised on Mexican Internet sites. However, Fullerton and Miranda (2011) find that not all brand name drugs available at walk-in pharmacies in Mexico are priced lower than counterpart products sold in the United States. In fact the price differentials reported in that study are broadly similar to those shown in Table 1. Pharmaceutical companies may be hesitant to sell medications at lower prices to residents of Mexico due to concerns that these medicines could be imported to the United States and undercut prevailing prices in that market (Danzon and Furukawa, 2003).

Chart 1 presents the unit price data from Table 1 in graphical form. Each of the 50 medicines in the sample is represented by a dot that lies at

the intersection of the United States unit price, corresponding to the horizontal axis, and the Mexican unit price, corresponding to the vertical axis. Because the dollar values of medicines included in the sample span a large range, the axes are logarithmically scaled. The 45^{O} line emanating from the origin represents equality between US and Mexican unit prices. Dots to the northwest of this line represent medications that are more expensive in Mexico while those located to the southeast of the line represent drugs that are more expensive in the United States. Although many of the prices are clustered fairly closely to the 45^{O} line, it is easy to see that most medications are more expensive when purchased from north of the border internet pharmacies.

Although a majority of the Mexico online prices in Table 1 are lower than the corresponding prices from north of the border, it is not clear whether those differences are statistically significant. The price differences are first examined using a standard parametric t-test. The null hypothesis for this test is that the differences in the unit prices of medicines from both countries are equal to zero. Although the unit prices of medicines from online pharmacies in Mexico are lower than those from the United States, the difference is statistically insignificant at the 5-percent level. As noted in Table 2, the calculated t-value is 0.53, which is less than the critical t-value of 2.01.

However, the t-test assumes data normality and previous research indicates that cross-border price data frequently fail to satisfy this assumption (Fullerton and Coronado, 2001). Given that, the Jarque-Bera test is performed in order to examine whether the normality assumption is satisfied (Bera and Jarque, 1981). As shown in Column 9 of Table 1, the null hypothesis of normality for the medicine price differences is rejected at the 1-percent level of significance (Table 1). On the basis of this result, it appears that the sample data for the price differences do not follow a normal distribution and an alternative test should be employed.

Because the normality assumption is not satisfied, a non-parametric test is also utilized. A signed rank test (Wilcoxon, 1945) is used to test the null hypothesis that the differences in the unit prices of medicines in both countries are equal to zero. The Wilcoxon is approximately standard normal for samples with more than 25 observations. The test result reported in Table 2 shows that the calculated Wilcoxon T-score is 4.47, which is greater than the critical t-value of 2.01. Accordingly, the null hypothesis of price equality is rejected at a 5-percent level of significance. The evidence provided by this alternative test indicates that differences in online medicine prices between Mexico and the United States are, in fact, statistically significant.

Ten of the medications carry negative signs for the United States-Mexico price differentials. Similar to what has been reported for walk-in pharmacies (Fullerton and Miranda, 2011), this means that some prescription drugs are less expensive in the United States than in Mexico. These medicines are mostly clustered among the treatments for depression and diabetes. A possible reason why there are higher prices for diabetes medications in Mexico may be greater demand. Mexico has a higher rate of deaths by diabetes than the United States (Alwan, 2011). Other factors may also influence this differential, including costs of production and price competition (Mujumdar and Pal, 2005).

Not all the medicines that exhibit Internet price differences offer consequential monthly savings to consumers. In order to calculate the monthly savings per medicine, the recommended daily dosages are employed. The recommended daily doses are retrieved from the online prescription information for each brand name medication. The number of daily units multiplied by the unit price equals the daily cost per medicine. This value multiplied by 30 days provides the monthly expenditure for the medication in each country. The differences between the monthly expenses in Mexico and those in the United States are the monthly savings associated

with buying the medicines from the websites in either country (Table 1).

The medicines that generate the largest savings for consumers willing to buy them online are Gleevec, Atripla, and Truvada. Gleevec (Imatinib) is manufactured by Novartis Corporation and used in the treatment of certain types of cancer. Atripla (Emtricitabine/ Tenofovir/ Efavirenz) is manufactured by Gilead Sciences Inc. and used for the treatment of human immunodeficiency virus (HIV). Truvada (Tenofovir/ Emtricitabine) is also manufactured by Gilead Sciences Inc. and used in the treatment of HIV. Online purchases of these medicines result in savings of greater than $500 dollars per month when they are bought over the Internet from Mexico (Table 1).

The average monthly savings for online purchases from Mexico is $131.73, while the sample standard deviation is $308.11. Only Gleevec, Atripla, and Truvada are more than one standard deviation above the mean for nominal savings. None of the monthly savings in the sample are more than one standard deviation below the mean (-$176.38). The average monthly savings available from brick and mortar pharmacies in Ciudad Juarez is $24.27 (Fullerton and Miranda, 2011).

The large savings gap is partly due to sample divergences between the two studies. If the comparison is limited to medicines that appear in both samples, then the average monthly savings for purchases at brick and mortar pharmacies in Ciudad Juarez is $24.61, whereas for Mexican online pharmacies it is $22.68. This result points to remarkable price similarities among these alternative means for acquiring prescription drugs from Mexico. The relatively low monthly savings based on prices alone also implies that much of the savings available to consumers may relate to avoiding doctor appointments when purchasing pharmacy products in Mexico. The savings can become proportionately larger, however, in cases where patients purchase more than one medicine.

Consumers make choices on health expenditures that involve several costs. The price of medications is one of these costs. Another important item is the cost of obtaining the prescription, i.e., the price of doctor appointments and visits. In general, doctor appointments are less expensive in Mexico than in the United States. Arredondo et al. (1999), find that the cost of outpatient doctor appointments in Mexico are $7.90 on average, which, adjusted for exchange rate fluctuations, was $10.33 in December 2010. That figure corresponds to a 130 peso per visit charge and approximately matches the fees quoted over the telephone by several doctor's offices in Ciudad Juarez during the first quarter of 2012. By comparison, the Medicare fee schedule indicates that the 2010 price for doctor appointments in the United States is approximately $109.86. The sizeable bi-national gap in the cost of doctor appointments is similar in magnitude to the gap between per capita total health expenditures in Mexico and the U.S. (WHO, 2012).

Most of the medicines in the sample do not, however, require written prescriptions when purchased in Mexico. Sales of Levaquin in Mexico now require prescriptions as a consequence of the 25 August 2010 antibiotics law. This law stipulates that the sale of antibiotics requires written prescriptions from doctors who hold medical licenses (Cédula Profesional) in Mexico (Sánchez, 2010). Internet sales of antibiotics are also covered by this regulation. Given the price of doctor appointments in the United States, the fact that Mexico does not require prescriptions for most medicines provides a fairly attractive incentive to north-of-the border consumers to consider making international online purchases. Depending on how often doctor visits may be required, the savings provided by avoiding office appointment fees can be substantial for some patients.

Although FDA regulations specify that drugs imported to the United States should be used under medical supervision, proof of such supervision is rarely required in practice (FDA, 2010; Rabinovitch,

2005). Aside from issues regarding legality, sales of drugs without medical consultations or prescriptions raise questions of consumer safety (Vargas-Hernández, 2005). While less stringent pharmaceutical purchase regulations in Mexico may reduce consumer costs in some cases, it may also lead to mistaken usage of self-prescribed medication and ultimately impose substantial long-term costs. It should not, however, be assumed that most United States residents who purchase medications in Mexico do so with the aim of evading appropriate medical evaluation. According to Calvillo and Lal (2003), 59 percent of United States residents who cross the border to purchase medicines at walk-in pharmacies in Mexico report being advised to take the medicine by a physician.

Material in Table 1 indicates that online prices for many medicines are less expensive in Mexico. Table 3 presents additional evidence regarding the relationship between the online unit prices of medicine in the United States and Mexico. The correlation coefficient for both sets of prices is 0.843, indicating that there is a strong relationship between the online prices in each country for these medicines. Given that, an interesting question is whether the prices in one country can serve as reliable explanatory variables for those in the second country.

The United States is the target market for online prescription medicines included in this sample. Accordingly, the Internet pharmacy prices from Mexico are regressed upon their counterparts from north of the border. The specification for this arrangement in which the direction of causality is assumed to be from north to south is shown in Equation (2). In (2), PMEXi is the Mexico unit price for medicine i, PUSAi is the United States unit price for medicine i, and ui is a stochastic disturbance.

$$PMEX_i = b_0 + b_1 * PUSA_i + u_i \quad (2)$$

If the unit product prices from the United States provide unbiased estimates of the Mexico web site prices, then the intercept in (2) will be equal to zero and the slope coefficient will be equal to one. The formal null hypotheses for bias are shown in Equation (3). Parameter estimation results and computed test statistics for Equations (2) and (3) are shown in Table 4.

$$H_0: b_0 = 0, b_1 = 1 \quad \text{vs.}$$
$$H_A: b_0 \neq 0, b_1 \neq 0, \quad (3)$$

In Table 3, the intercept term is -5.599. With a standard deviation of 4.414, it is not statistically different from zero. Given that, it is not possible to reject the null hypothesis that the constant term is equal to zero. The estimated slope coefficient is 1.031. The computed t-statistic for the hypothesis that the slope coefficient is equal to one is -0.331. Consequently, it is not possible to reject the hypothesis that b1 is equal to one. These results indicate that the intercept and slope coefficients are statistically indistinguishable from 0 and 1, respectively. That implies that the online unit price of medicine in the United States can serve as a reliable predictor of the Internet unit price of medicine in Mexico.

Conclusion

Conventional wisdom indicates that brand name prescription medicine prices are lower at online Mexican pharmacies than at United States Internet drug stores. Data collected for this study corroborate that belief, at least to a large extent. Consumers will save an average of $131.73 dollars per month when buying from online pharmacies south of the Rio Grande. The savings are even larger when the cross-border differences in the fees charged for doctor's appointments are taken into account. However, not all medicines are more affordable in Mexico. Pharmaceuticals designed to treat diabetes tend to be less expensive in the United States. In all, ten of the fifty prescription drugs included in the sample are less expensive when purchased in the U.S.

Data in this study indicate that online medicine prices in Mexico are higher than those charged by brick and mortar pharmacies located in Mexico. That may be due to the fact that transportation costs and time spent waiting to re-enter the United States make the effective delivery prices for walk-in pharmacies noticeably higher than the shelf prices for the products in question. Reduced medical tourism from the United States in response to security concerns in northern Mexico potentially contributes to this pricing pattern, also.

Linear regression results reported above indicate that the Internet prices listed in the United States provide unbiased estimates of the online pharmacy prices charged in Mexico. Because the sample utilized is cross-sectional and includes data only for October 2011, it is not possible to examine how that relationship varies over time. A natural extension of this initial study would be to collect these data over time to permit analyzing the dynamic properties associated with online pharmacy prices in these two countries.

References

Alwan, A. (2011), *Noncommunicable Diseases and Mental Health* (Geneva: World Health Organization). Available at: http://www.who.int/nmh/countries/en/ (accessed 23 January 2012).

APC (2001), *International Pharmaceutical Price Differences* (Canberra: Australian Productivity Commission). Available at: http://www.pc.gov.au/__data/assets/pdf_file/0018/18153/pbsprices.pdf (accessed 7 November 2011).

Arredondo, A., R. Leyva and P. Nájera (1999), 'Atención Médica Ambulatoria en México: El Costo para los Usuarios', *Salud Pública de México*, 41, 1, 18-46.

Bera, A. K. and C. M. Jarque (1981), 'Efficient Tests for Normality, Heteroscedasticity, and Serial Independence of Regression Residuals: Monte Carlo Evidence', *Economics Letters,* 7, 4, 313-18.

Byrd, T.L. and J.G. Law (2009), 'Cross-Border Utilization of Healthcare Services by United States Residents Living near the Mexican Border', *Pan American Journal of Public Health,* 26, 2, 95-100.

Calvillo, J.P. and L. Lal (2003), 'Pilot Study of a Survey of US Residents Purchasing Medications in Mexico: Demographics, Reasons, and Types of Medications Purchased', *Clinical Therapeutics*, 25, 2, 561-577.

Christopher, C.G., A. Prlic and Y. Li (2011), 'Consumer Markets', U.S. *Economic Outlook: June 2011* (New York, NY: IHS Global Insight), 7-19.

CBP (2011), *FDA Enforcement Policy Regarding the Personal Import of Violative Drugs* (Washington DC: U.S. Customs and Border Protection). Available at: http://www.cbp.gov/xp/cgov/travel/clearing/restricted/medication_drugs.xml (accessed 3 October 2011).

Danzon, P.M. and L. Chao (2000), 'Cross-national Price Differences for Pharmaceuticals: How Large, and Why?', *Journal of Health Economics,* 19, 2, 159-95.

Danzon, P.M. and M.F. Furukawa (2003), 'Prices and Availability of Pharmaceuticals: Evidence from Nine Countries', *Health Affairs Web Exclusive*, 29 October, 521-36. Available at: http://www.healthaffairs.org/WebExclusives.php (accessed 3 October 2011).

de Guzman, G.C., Khaleghi, M., Riffenberg, R.H. and R.F. Clark (2007), 'A Survey of the Use of Foreign-Purchased Medications in a Border Community Emergency Department Patient Population', *Journal of Emergency Medicine*, 33, 2, 213-221.

FDA (2010), Regulatory Procedures Manual (Silver Spring, MD: Food and Drug Administration). Available at: http://www.fda.gov/ICECI/ComplianceManuals/RegulatoryProceduresManual/ucm179266.htm (accessed 10 December 2012).

Fullerton, Jr., T.M. and R. Coronado (2001), 'Restaurant Prices and the Mexican Peso', *Southern Economic Journal,* 68, 1, 145-155.

Fullerton, Jr., T.M. and O. Miranda (2011), 'Borderplex Brand Name Medicine Price Differences', *Applied Economics*, 43, 8, 929-939.

IMS (2012), 'The Use of Medicines in the United States: Review of 2011', IMS Institute for Healthcare Informatics. Available at: http://www.imshealth.com/portal/site/ims (accessed 4 December 2012).

Kanavos, P.G. and S. Vandoros (2011), 'Determinants of Branded Prescription Medicine Prices in OECD Countries', *Health Economics, Policy and Law,* 6, 3, 337-367.

Manning, R.L. (1997), 'Products Liability and Prescription Drug Prices in Canada and the United States', *Journal of Law and Economics*, 40, 1, 203-244.

Mujumdar, S. and D. Pal (2005), 'Do Price Ceilings Abroad increase US Drug Prices?', *Economics Letters*, 87, 1, 9-13.

Quon, B.S., R. Firszt and M.J. Eisenberg (2005), 'A Comparison of Brand Name Drug Prices Between Canadian-based Internet Pharmacies and Major US Drug Chain Pharmacies', *Annals of Internal Medicine,* 143, 6, 397-403.

Rabinovitch, S.R. (2005), 'On the Legitimacy of Cross-Border Pharmacy', *Alberta Law Review,* 43, 2, 327-368.

Ridley, D.B. (2005), 'Price Differentiation and Transparency in the Global Pharmaceutical Marketplace', *Pharmacoeconomics*, 23, 7, 651-658.

Saatsoglou, P. (2004), 'Pharmaceutical Reimportation: Magnitude, Trends, and Consumers', *Managed Care*, 13, 3, 7-9.

Sánchez, J. (2010), 'Ley para Antibióticos una Necesidad', *El Universal,* 27 May, 1.

Vargas Hernández, J.G. (2006), 'Mercado Transfronterizo en Servicios de Salud', *Ciudades*, 69, 58-64.

Wagner, J.L. and E. McCarthy (2004), 'International Differences in Drug Prices', *Annual Review of Public Health,* 25, 1, 475-4t95.

Wilcoxon, F. (1945), 'Individual Comparisons by Ranking Methods', *Biometrics Bulletin*, 1, 6, 80-83.

WHO (2012), *World Health Statistics 2012,* (Geneva: World Health Organization). Available at: http://www.who.int/gho/publications/world_health_statistics/en/index.html (accessed 1 June 2012).

Table 1. Brand name medication prices for online pharmacies in the United States and Mexico.

Name	Dosage*	USA Price	# of units	USA Unit Price	MEX Price	# of units	MEX Unit Price	Difference UUS-UMX**	Units per day	Monthly Cost USA	Cost/ Month MEX	Savings/ Month**
Abilify	10 mg.	546.98	30	18.23	118.95	10	11.90	6.34	1.00	546.98	356.85	190.13
Aciphex	20 mg.	233.99	30	7.80	147.22	28	5.26	2.54	1.00	233.99	157.74	76.25
Actos	30 mg.	278.99	30	9.30	134.31	14	9.59	-0.29	1.00	278.99	287.81	-8.82
Advair Diskus	100/50 mg.	189.99	60	3.17	101.53	60	1.69	1.47	2.00	189.99	101.53	88.46
Aricept	10 mg.	304.91	30	10.16	176.68	28	6.31	3.85	1.00	304.91	189.30	115.61
Atripla	600/200/300 mg.	1,878.96	30	62.63	487.50	30	16.25	46.38	1.00	1,878.96	487.50	1,391.46
Benicar	4 mg.	125.49	30	4.18	90.00	30	3.00	1.18	1.00	125.49	90.00	35.49
Boniva	150 mg.	128.99	1	128.99	121.20	1	121.20	7.79	0.03	116.09	109.08	7.01
Celebrex	200 mg.	140.99	30	4.70	76.52	30	2.55	2.15	1.00	140.99	76.52	64.47
Cialis	20 mg.	209.99	10	21.00	104.90	4	26.23	-5.23	1.00	629.97	786.75	-156.78
Crestor	10 mg.	154.99	30	5.17	79.56	30	2.65	2.51	1.00	154.99	79.56	75.43
Cymbalta	60 mg.	170.99	30	5.70	171.77	28	6.13	-0.43	1.50	256.49	276.06	-19.57
Detrol LA	4 mg.	168.99	30	5.63	72.00	30	2.40	3.23	1.00	168.99	72.00	96.99
Diovan	80 mg.	95.99	30	3.20	79.47	30	2.65	0.55	1.00	95.99	79.47	16.52
Diovan HCT	160/25 mg.	126.99	30	4.23	171.36	28	6.12	-1.89	1.00	126.99	183.60	-56.61
Effexor XR	37.5 mg.	136.99	30	4.57	100.30	20	5.02	-0.45	2.50	342.48	376.13	-33.65
Femara	2.5 mg.	516.96	30	17.23	174.00	30	5.80	11.43	1.00	516.96	174.00	342.96
Flomax	0.4 mg.	153.99	30	5.13	95.32	20	4.77	0.37	1.00	153.99	142.98	11.01
Geodon Oral	40 mg.	520.97	60	8.68	193.02	28	6.89	1.79	2.00	520.97	413.61	107.36
Gleevec	500 mg.	1,506.03	30	50.20	450.00	30	15.00	35.20	1.50	2,259.05	675.00	1,584.05
Januvia	100 mg.	216.00	30	7.20	111.45	28	3.98	3.22	1.00	216.00	119.41	96.59
Lantus	0.1 ml.	331.98	3	110.66	325.00	3	108.33	2.33	0.01	33.20	32.50	0.70
Lantus SoloSTAR	0.1 ml.	196.17	1	196.17	325.00	1	325.00	-128.83	0.03	176.55	292.50	-115.95
Levaquin	250 mg.	484.97	30	16.17	69.58	30	2.32	13.85	1.00	484.97	69.58	415.39
Lexapro	10 mg.	118.99	30	3.97	139.86	28	5.00	-1.03	1.00	118.99	149.85	-30.86
Lipitor	20 mg.	159.99	30	5.33	219.39	30	7.31	-1.98	1.00	159.99	219.39	-59.40
Lyrica	150 mg.	94.99	30	3.17	95.04	28	3.39	-0.23	2.50	237.48	254.57	-17.10

Namenda	10 mg.	223.00	60	3.72	61.50	30	2.05	1.67	1.50	167.25	92.25	75.00
Nasonex	50 mcg.	130.99	1	130.99	26.99	1	26.99	104.00	0.02	62.88	12.96	49.92
Nexium	20 mg.	200.99	30	6.70	51.76	14	3.70	3.00	1.00	200.99	110.91	90.08
Niaspan	500 mg.	89.99	30	3.00	27.60	30	0.92	2.08	2.50	224.98	69.00	155.98
Plavix	75 mg.	195.99	30	6.53	122.04	28	4.36	2.17	1.00	195.99	130.76	65.23
Premarin	0.625 mg.	65.10	30	2.17	50.48	28	1.80	0.37	0.60	39.06	32.45	6.61
Protonix	40 mg.	190.00	30	6.33	30.79	14	2.20	4.13	1.50	285.00	98.97	186.03
Restasis	0.2 ml.	146.62	30	4.89	150.83	30	5.03	-0.14	2.00	293.24	301.66	-8.42
Seroquel	100 mg.	364.98	60	6.08	109.35	30	3.65	2.44	1.50	273.74	164.03	109.71
Seroquel XR	300 mg.	410.40	30	13.68	206.00	30	6.87	6.81	1.50	615.60	309.00	306.60
Singulair	10 mg.	160.99	30	5.37	93.92	20	4.70	0.67	1.00	160.99	140.88	20.11
Spiriva	18 mg.	245.98	30	8.20	60.76	20	3.04	5.16	1.00	245.98	91.14	154.84
Strattera	10 mg.	190.00	30	6.33	78.48	14	5.61	0.73	1.00	190.00	168.17	21.83
Symbicort	160/4.5 mg.	229.99	120	1.92	68.80	60	1.15	0.77	4.00	229.99	137.60	92.39
Synthroid	150 mg.	33.99	30	1.13	45.39	50	0.91	0.23	1.00	33.99	27.23	6.76
Truvada	200/300 mg.	1,085.04	30	36.17	495.00	30	16.50	19.67	1.00	1,085.04	495.00	590.04
Valtrex	500 mg.	235.98	30	7.87	265.00	42	6.31	1.56	3.00	707.94	567.86	140.08
Ventolin HFA	90 mcg.	45.99	1	45.99	37.43	1	37.43	8.56	0.03	41.39	33.69	7.70
Viagra	50 mg.	193.99	10	19.40	75.00	4	18.75	0.65	1.00	581.97	562.50	19.47
Vytorin	10/20 mg.	134.99	30	4.50	51.18	14	3.66	0.84	1.00	134.99	109.67	25.32
Xalatan	2.5 ml.	104.99	1	104.99	39.99	1	39.99	65.00	0.02	69.29	26.39	42.90
Zetia	10 mg.	139.99	30	4.67	88.30	20	4.42	0.25	1.00	139.99	132.45	7.54
Zyprexa	10 mg.	624.01	30	20.80	98.12	7	14.02	6.78	1.00	624.01	420.51	203.50
Mean		292.79		23.48	135.31		18.62	4.86		341.49	209.77	131.73
SD		338.88		40.32	109.65		49.27	26.46		415.39	179.94	308.11
Skewness		3.30		2.72	1.99		5.25	-1.22		3.25	1.43	3.71
Kurtosis		11.82		7.33	3.84		30.60	16.39		11.94	1.59	14.83
JB Statistic		317.34 ***		146.18***	54.44 ***		1793.10 ***	460.46 ***		319.49	19.55	474.36

Notes:
All data are from the week of 10-14 October 2011.
All medicine dosages are equal for both countries.

Lantus and Lantus SoloSTAR assume a requirement of 3 units/ml per day.
Nasonex contains 120 sprays per bottle (50 mcg/act), with a suggested application of 2 sprays daily.
Restasis contains 2 drops per ampule (0.05%4ml), with a suggested application of 4 drops daily.
Ventolin HFA contains 200 puffs per inhaler (108-90mcg), with a suggested application of 6 puffs daily.
Xalatan contains 45 drops per bottle (2.5ml), with a suggested application of 1 drop daily.
Negative numbers indicate savings result from purchases at United States online pharmacies.
Data are from bajapharmacy.com, drugstore.com, familymeds.com, medsmex.com and pharmaciesherbal.com.
* If brand name medicines contain ingredients of multiple generic medicines, the dosages of those medicines are separated by slashes.
** Negative numbers indicate prices are more expensive at Mexican online pharmacies.
*** Significant at 1-percent level.

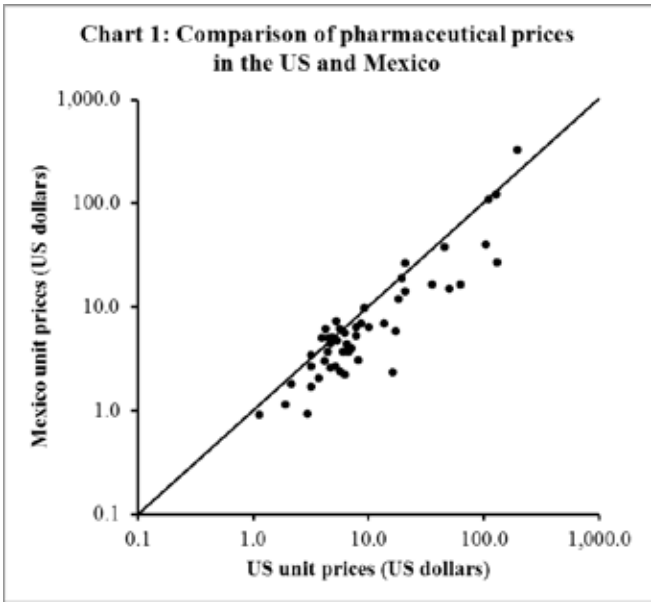

Table 2. Parametric and Non-parametric Tests for Unit Price Equality.

Computed Test Statistic	1-Percent Critical Value	Decision
t-hat = 0.535	2.678	Fail to reject null hypothesis unit price equality.
Wilcoxon T-score = 4.474	2.678	Reject the null hypothesis of unit price equality.

Table 3. United States and Mexico Online Pharmacy Price Regression Results.

Regression Test for Predictive Bias: Ho: $b_0 = 0.0$, $b_1 = 1.0$
Dependent Variable: P_{MEXi} (Mexico Unit Price)
Method: Least Squares
Sample: 1 50
Included observations: 50

Independent Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Probability**
Constant	-5.598827	4.414058	-1.268408	0.2108
P_{USAi} (USA Unit Price)	1.031296	0.094604	10.90124	0.0000

R-squared	0.712294	Mean dependent variable	18.61600
Adjusted R-squared	0.706300	Std. deviation dep. variable	49.76926
Standard error of regression	26.97199	Log likelihood	-234.6663
Sum squared residuals	34919.45	F-statistic	118.8370

Notes:
1. Rho(P_{MEXi}, P_{USAi}) = 0.843
2. For H_0: $b_0 = 0.0$, H_A: $b_0 \neq 0.0$, t-hat = 1.268 < t-critical= 2.010, fail to reject Ho at 5-percent level.
3. For H_0: $b_1 = 1.0$, H_A: $b_1 \neq 1.0$, t-hat = 0.331 < t-critical= 2.010, fail to reject Ho at 5-percent level.
4. Parameter estimates and test results indicate that USA unit prices are unbiased predictors of Mexico prices.

The University of Texas at El Paso

Announces

Borderplex Economic Outlook: 2013-2015

UTEP is pleased to announce the 2013 edition of its primary source of border business 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 255-equation UTEP Border Region Econometric Model developed under the auspices of a corporate research gift from El Paso Electric Company.

The authors of this publication are UTEP Professor & Trade in the Americas Chair Tom Fullerton and UTEP Associate Economist Adam Walke. 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. Adam Walke holds an M.S. in Economics from UTEP and has published research on energy economics, mass transit demand, and cross-border regional growth patterns.

The border business outlook for 2013 through 2015 can be purchased for $10 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 University of Texas at El Paso for $10 to:

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

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

The University of Texas at El Paso

Announces

Borderplex Long-Term Economic Trends to 2029

UTEP is pleased to announce the availability of an electronic version of the 2010 edition of its primary source of long-term border business outlook information. Topics covered include detailed economic projections for El Paso, Las Cruces, Ciudad Juárez, and Chihuahua City. Forecasts are generated utilizing the 225-equation UTEP Border Region Econometric Model developed under the auspices of a 12-year corporate research support program from El Paso Electric Company.

The authors of this publication are UTEP Professor & Trade in the Americas Chair Tom Fullerton and former UTEP Associate Economist Angel Molina. 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. Angel Molina holds an M.S. Economics degree from UTEP and has conducted econometric research on international bridge traffic, peso exchange rate fluctuations, and cross-border economic growth patterns.

The long-term border business outlook through 2029 can be purchased for $10 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 University of Texas at El Paso for $10 to:

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

Request information at 915-747-7775 or agwalke@miners.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 $10 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?*

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*

Technical Report TX14-2 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

www.utep.edu