

EMPIRICAL EVIDENCE REGARDING 9/11 IMPACTS ON THE BORDERPLEX ECONOMY

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Abstract

Although not directly targeted by any of the terrorist attacks of 11 September 2001, the El Paso – Ciudad Juárez borderplex economy was impacted by related administrative events that subsequently occurred. To examine what areas of the regional economy were affected, a series of statistical tests are employed. Similar to what has been documented for the New York metropolitan economy, many sectors of the borderplex escaped the aftereffects of 9/11 without observing large scale changes. Several other sectors, however, were impacted in statistically significant manners.

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1. Introduction

Because of geographic proximity and close business ties to Mexico, the El Paso metropolitan economy faced a variety of downside risks in the aftermath of the terrorist attacks on 11 September 2001. The primary source behind those risks is increased border crossing times for northbound traffic coming into the United States over the various bridges that link El Paso, Texas and Ciudad Juárez, Chihuahua. Border transit delays potentially affect several

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segments of the borderplex regional economy principally comprised by these two cities.

A recent survey conducted among of households in Ciudad Juárez indicates that the top reason for residents to embark on shopping trips to El Paso is lower prices. Ranking far below pricing are product quality and variety as the second and third most important reasons for shopping on the north side of the Rio Grande River (Flores, 2005). Longer transit times at the international bridges obviously increase the opportunity cost of shopping in El Paso. They also increase the effective delivery prices of any merchandise purchased due to lower gas mileages and higher travel costs (Di Pasquale and Wheaton, 1996; Janssen, Karamychev, and van Reeve, 2005). Such a scenario would also permit net increases in retail sales in Ciudad Juárez due to reduced northbound customer flows to El Paso.

Under these circumstances, increases in border transit times may lead to reduced international customer traffic flows in the borderplex. Retail sales volumes would potentially decline in response. Air transportation, in-bond assembly operations in Ciudad Juárez, and other categories of commercial activity may also have been affected. To investigate these possibilities, elementary statistical analyses are carried out using the borderplex econometric modeling system (Fullerton, 2001). Subsequent sections include a brief review of the literature, data and methodology, empirical results, and conclusions.

2. Related Studies

Cross-border retail sales represent an important component of commercial sector activity in El Paso. Comprehensive data do not exist for sales in El Paso to residents of Mexico. In part, that is because they potentially fluctuate by very large percentages in response to business cycles, currency market conditions, and bridge delays. However, a range of estimates indicate that these sales may annually exceed \$600 million and potentially even approach \$1.7

billion (Fullerton, Torres, Barraza, and Amastae, 2003; Flores, 2005; Phillips and Coronado, 2005).

Many of the earlier studies focus on exchange rate impacts on retail sales due to purchasing power losses faced by Mexican consumers (Sprinkle, 1983; Patrick and Renforth, 1996; González Gómez, Deantes del Ángel, and Pérez Sánchez, 1997; Hadjimarcou and Barnes, 1998). Because there have been 9 large-scale devaluations of the peso during the past eighty years (1925, 1934, 1940, 1948, 1954, 1976, 1982, 1986, 1994), this approach has obvious relevance to studies of border economic performance. It was widely assumed in many border settings, in fact, that macroeconomic recessions in Mexico are exclusively triggered by currency market disequilibria.

The emergence of the maquiladora industry following the termination of the bracero program in 1965 naturally led border economic research to examine other issues, as well. One recurring category involves cross-border labor market interactions (Gruben, 1990; Coronado, Fullerton, and Clark, 2004; Cañas, Fullerton, and Smith, 2007). Another related area involves industrial development and intra-industry trade (Hanson, 1996, 1998, 2001; Fullerton and Tinajero, 2002; Cañas, Pallares, and Torres Ruiz, 2005). These, and a variety of other, studies empirically document increasing levels of economic linkages across the international boundary that separates Mexico and the United States.

Those linkages were disrupted, at least temporarily, by two developments in 2001. The first was the emergence of a business cycle downturn in Mexico that was not accompanied by a maxi-devaluation of the peso (Gilmer, 2002). The second was the temporary closure of the border following the terrorist attacks on 11 September 2001. The initial closures were followed by notably longer transit times from Mexico into Texas at nearly every port of entry. Limited econometric evidence of these disruptions on subsequent air and bridge travel volumes has been documented for El Paso (Fullerton, 2004).

That some evidence of economic dislocation emerges for El Paso is not surprising. Several recent studies have examined potential losses that regions can experience as consequences of warfare and terrorism (Glaeser and Shapiro, 2002; Mills, 2002; Rossi-Hansberg, 2004). What also becomes apparent from these studies is that urban geographies and information networks are such that even large-scale disruptions to metropolitan economies will not affect all markets in uniform manners. Some segments of cities may even experience ongoing expansion in spite of negative shocks to the local area.

Of all the regional economies impacted by the 9/11 disruptions, New York experienced the most severe disruptions. While two of the worst attacks succeeded in destroying an important part of Manhattan, much of the metropolitan economy exhibited a strong degree of resiliency in handling the fallout from the airplane crashes (Haughwout and Rabin, 2005). In particular, a series of F-tests in that study document an unexpectedly strong performance by the real estate sector in much of the city. A similar approach can also be utilized to examine post-9/11 economic performance in the borderplex.

3. Data and Methodology

Due in part to proximity to an international boundary, several border economy sectors are likely to have observed statistically significant consequences associated with the aftermath of 9/11. Included among those are retail trade, hotel and lodging, cross-border surface transportation, air transportation, and in-bond manufacturing. While the entire border from Brownsville to San Diego has probably observed these changes, material below focuses on the El Paso and Ciudad Juárez portions of the borderplex regional economy. Annual frequency data are employed in the study. All of the data utilized can be accessed via the Border Region Modeling Project information housed on the University of Texas at El Paso web site (www.utep.edu).

When examining the possible natures of various types of changes on any regional economy, there are a number of methodologies that

can yield helpful insights (Sen and Smith, 1995). Ideally, sufficient sample observations will be available to permit estimating the kinds of models that have been employed in analyses of other border economic phenomena such as the North American Free Trade Agreement or real exchange rate fluctuations (Gould, 1998; Gruben, 2001; Campbell and Lapham, 2004). At present, that is not the case for much of the borderplex and a large number of other regional economies.

Because degree of freedom constraints limit the types of analyses that can currently be undertaken for El Paso and Ciudad Juárez, the approach utilized below is one that has also proven helpful in documenting the impacts of 9/11 on the metropolitan New York economy (Haughwout and Rabin, 2005). The technique employed involves dummy variables that allow for the possibility of both level effects and interaction effects to occur (Pindyck and Rubinfeld, 1998). Assume the following economic relationship exists prior to an event such as 9/11:

$$(1) \quad Y_t = b_0 + b_1 * X_t + u_t, \text{ where}$$

Y is a variable whose behavior is functionally dependent on X,
X is a regressor that may or may not be continuous,
u is a random disturbance term, and
t is a discrete time index.

Subsequent to the shock to the system, the relationship shown in Equation (1) may or may not continue to hold. One possibility is that the level of activity drops as a consequence of the shock, but the link between the independent variable and the left-hand-side variable remains in tact. Another possibility is that the relationship between the explanatory variable and the dependent variable changes while the intercept remains the same.

It is also possible that both parameters in Equation (1) will change after the event. Equation (2) presents one specification that allows for changes in the underlying relationships that characterize the market in question. This is achieved by introducing a dummy

variable for level effects and also interacting it with the explanatory variables used as regressors:

$$(2) \quad Y_t = b_0 + b_1 * X_t + a_0 * DV_t + a_1 * DV_t * X_t + v_t,$$

Where

Y is a variable whose behavior is functionally dependent on X,

X is a regressor that may or may not be continuous,

v is a random disturbance term,

DV = 0 prior to the shock,

 = 1 after the shock, and

t is a discrete time index.

Versions of the borderplex econometric equations for retail sales, hotel activity, international bridge traffic, air transportation, and maquiladora equations are estimated using the basic specifications shown in Equations (1) and (2). The sectors included are determined by data availability and that is not uniform across both sides of the international boundary (Fullerton, 2001).

The 9/11 terrorist attacks resulted in longer transit times at the international bridges and disrupted air travel patterns as a consequence of new screening and inspection procedures, as well as other changes. To examine what equations exhibit statistically discernible impacts from those outcomes, a combination of t-tests and F-tests are used. The former allow for individual coefficient heterogeneity and the latter allow for simultaneous changes to both constant terms and slope parameters. Those results are summarized in the next section.

4. Empirical Results

The first category shown in Table 1 is retail sales in El Paso. None of the intercept or slope coefficient statistics for retail sales in El Paso satisfy the 5-percent t-test significance criterion. In one case, general merchandise sales, the 1-percent F-test significance criterion is satisfied. General merchandise sales include apparel,

household appliances, furniture, and home furnishings. The breadth of merchandise covered reflects the wide range of items typically purchased by customers from Mexico in El Paso every year (Phillips and Coronado, 2005). That commercial relationship seems to have been weakened by events associated with 9/11.

The second category listed is for hotels and lodging. Variations in the numbers of hotels operating and the numbers of rooms available do not satisfy the respective significance levels. However, room prices dropped after the attacks. Similarly, the numbers of rooms sold in El Paso also declined after 9/11. Both of those effects potentially reflect reduced numbers of travelers from Mexico, as well as fewer domestic trips by business visitors. The latter may partially be a consequence of lower investment in commercial and industrial activities involving operations located in Ciudad Juárez. It may also result from post-9/11 air travel disruptions.

Slightly more evidence in favor of post-9/11 structural change is reported for northbound international bridge traffic into El Paso. That is not surprising due to the more stringent inspection procedures adopted in the aftermath of the terrorist attacks. For several months during 2001 and 2002, it was not uncommon for vehicular traffic to last three hours or more in the bridge queues. Three of those traffic categories exhibit statistically significant changes in their respective data patterns. Those series include passenger vehicles across two of the bridges plus one pedestrian traffic series.

Neither of the cargo truck sets of data have statistically significant results associated with them. Given the depth of the maquiladora sector downturn in Ciudad Juárez in 2001 and 2002, that may seem surprising (Fullerton, 2004). Although in-bond assembly output levels definitely declined during this period, many companies reacted to the uncertainties over daily bridge transit times by increasing the numbers of trucks sent back north. The latter practice causes inefficiencies due to sending many tractors to haul only partially filled cargo bays. It helps minimize, however, the risk of failing to meet just-in-time delivery schedules during months when heightened

security alerts led to multi-hour portage delays. Because infrastructure bomb threats remain prevalent, and periodically occur in El Paso, this practice is not altogether surprising (Enders and Sandler, 2005).

Additional evidence of borderplex economic disruptions is uncovered among the air traffic data for El Paso International Airport. In all, five of the eight categories for which time series information exists exhibit statistically significant results. Those variables include in-bound and out-bound flows for both air freight and air mail. They also include deplaning domestic flight passengers, but not enplaning domestic flight travelers. In-bound international passenger volumes actually increased subsequent to the attacks, but the statistics calculated for them do not satisfy the significance criteria selected. It should be noted that the air mail results may also be due to the anthrax scares that occurred in the months surrounding the terrorist attacks (Anonymous, 2001).

Data constraints are more severe for the south side of the borderplex than they are north of the Rio Grande. Sufficient observations are available for only three variables in Ciudad Juárez. Those variables are maquiladora employment, maquiladora plants in operation, and an index for inflation adjusted retail sales. None of the computed statistics for the in-bound assembly factories satisfy the significance criteria. Statistically significant results are obtained, however, for the other two series.

For maquiladora employment, this is not surprising. More stringent inspection procedures effectively “widened” the border that separates the two countries and reduced the geographic proximity advantage historically enjoyed by Northern Mexico. This effect has probably been exacerbated by other factors such as an erosion of the “regulatory gap” that once separated Mexico from China (Fullerton and Barraza de Anda, 2003).

Retail sales in Ciudad Juárez exhibit significant impacts, also. That is in line with more shoppers remaining on the south side of the border due to the greater opportunity cost of the time expended in queues to cross over to El Paso. Tighter border controls have affected some categories of bridge traffic, especially in terms of

reduced passenger vehicle volumes (Fullerton, 2004). However, the emergence of greater retail activity in Ciudad Juárez tells only part of the story. As discussed above, there is a general absence of strong retail sales effects noted among most categories. That implies that fewer shopping trips to El Paso are potentially being offset by greater sales volumes once the consumers from Mexico do arrive. The concurrent evidence of stronger retail performance in Ciudad Juárez subsequent to 9/11 runs counter to that argument and additional research will be required before this issue can be settled.

Many of the segments of the borderplex economy seemingly at risk following the imposition of stricter security measures do not exhibit statistically significant evidence of post-9/11 impacts. That is similar to what has also been documented for the New York metropolitan economy where half of the airliner attacks actually occurred (Haughwout and Rabin, 2005). The absence of stronger borderplex empirical evidence may be because no infrastructure was destroyed there, only regulatory procedures in how that infrastructure is used changed. Once businesses and households became accustomed to the new policies, they likely adjusted their respective management practices to take them into account. Recent empirical analysis utilizing borderplex menu prices indicates that business managers in El Paso and Ciudad Juárez respond more quickly to currency market fluctuations than do their counterparts in non-border regions of the world (Blanco-González and Fullerton, 2006). Adjustments to new bridge and air regulations are not hard to envision for such an international setting. For terrorist attacks to have more noticeable effects, however, probably requires more severe disruptions than those observed in El Paso and Ciudad Juárez (Richardson, Gordon, and Moore, 2006).

5. Conclusion

Because it is traversed by an international boundary, the borderplex regional economy faced several important disruptions subsequent to the terrorist attacks on 11 September 2001. In particular, new regulatory procedures affected usage patterns at the

international airport and the international bridges. The ultimate effects of those changes have not previously been examined.

Empirical analysis is carried out using a series of t-tests and F-tests applied to data and equations that are used in the borderplex econometric forecasting model. A total of 31 separate variables are employed. Data included in the tests are from the retail, hotel, international bridge, airport, and maquiladora sectors of the modeling system.

A fair amount of evidence points to lasting impacts on several bridge and air traffic categories. Relatively little evidence of ongoing disruptions is uncovered for retail sales in El Paso, but retail sales in Ciudad Juárez seem to have benefited from the new administrative obstacles to crossing into El Paso. Taken together, these outcomes potentially reflect changes in household inventory management and business sector operational practices that take into account the new regulatory environment affecting borderplex infrastructure. Whether this is the case for other cities along the border, is an empirical question that remains unanswered at this juncture.

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Table 1- Empirical Test Results

Dependent Variable	b_0 t-statistic	b_1 t-statistic	Joint F-stat.
El Paso Hardware Stores	0.036	-1.310	2.041
El Paso General Merchandise	1.839	-1.343	10.389**
El Paso Food Stores	-0.564	0.557	0.456
El Paso Automobiles and Fuel	0.513	-0.463	0.473
El Paso Apparel and Accessories	0.445	-1.095	4.811
El Paso Furniture and Appliances	0.947	-0.989	2.952
El Paso Dining Establishments	-0.218	0.204	0.914
El Paso Pharmacies and Other	-0.178	0.194	0.188
El Paso Hotels in Operation	-0.331	-0.267	0.099
El Paso Hotel Room Nights Avail.	-0.333	0.267	6.232
El Paso Hotel Room Price	-1.711	0.505	8.117**
El Paso Hotel Rooms Sold	-2.838*	2.782*	4.184
Northbound Americas Bridge Cars	2.088*	-2.679*	13.636**
Americas Bridge Trucks	0.556	-0.581	0.217
Americas Bridge Pedestrians	1.034	-0.864	2.944
Northbound Santa Fe Bridge Cars	0.972	-1.718	1.530
Santa Fe Bridge Pedestrians	-0.315	0.437	1.194
Northbound Ysleta Bridge Cars	1.420	-1.605	6.871**
Northbound Ysleta Bridge Trucks	-0.238	0.783	1.846
Ysleta Bridge Pedestrians	4.550*	-2.715*	12.182**
El Paso In-Bound Air Freight	2.032*	-2.041*	5.216
El Paso Out-Bound Air Freight	-0.435	0.279	6.068**
El Paso In-Bound Air Mail	-0.602	0.423	6.803**
El Paso Out-Bound Air Mail	-0.765	0.511	16.901**
In-Bound Domestic Passengers	-2.106*	2.061*	2.484
In-Bound International Passengers	0.350	0.441	2.835
Out-Bound Domestic Passengers	-0.477	0.596	1.358
Out-Bound International Passengers	-0.596	-0.781	2.870
Cd. Juárez Maquiladora Employment	-0.582	0.391	24.873**
Maquiladora Plants in Operation	0.259	-0.197	0.180
Ciudad Juárez Retail Sales	2.329*	-2.043*	12.416**

Notes: The sample period is 1969-2005. * denotes 5-percent statistical significance. ** denotes 1-percent statistical significance.