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Background

Transportation infrastructure in the United States is primarily built, owned, and maintained by government agencies. Construction costs for new roads, plus maintenance and enhancements to existing road networks, create sizeable budgetary pressures that can exceed tax revenue capacity. In response, transportation departments have periodically employed tolls as a means for financing new infrastructure and/or maintaining it once developed. In many regions of the United States, tolls have provided funds that have helped alleviate grid deficiencies.

Tolls have also been utilized as a mechanism for controlling traffic volumes. Bridge, road, and tunnel fees can help diminish network congestion by increasing transportation costs and thereby reducing infrastructure loads. As congestion subsides, vehicle emissions are reduced, thereby protecting air quality. Improved technology employed in some areas of Texas allows electronic fee collection, eliminating the need for toll booths and allowing motorists to avoid wasting time in queues.

Tolls are charged on several of the international bridges that link El Paso and Ciudad Juarez. These user fess have quietly been in place for several decades and provide an important source of revenue for the physical infrastructure connecting these border metropolitan economies. Pedestrians, passenger vehicles, and commercial vehicles are charged for using three of the four bridges between the sister cities. Research recently completed at The University of Texas at El Paso examines the impacts of bridge fees, business cycles, and exchange rates on

cross-border regional travel patterns using data on the international bridge tolls charged by the City of El Paso on southbound traffic into Mexico. The studies also analyze the effects of currency values, regional economic conditions, and tolls charged on northbound traffic flows into the United States by the Caminos y Puentes Federales de Ingresos y Servicios Conexos (CAPUFE) agency of the federal government in Mexico.

In fiscal year 2009, total fees across all user categories for using that infrastructure are expected to generate approximately $16.9 million for the El Paso city budget (www.ci.el-paso.tx.us). Different types of users are associated with the various bridges. For example, the Santa Fe Bridge near downtown El Paso is typically used by pedestrian tourists from the United States who want to visit Mexico without driving. The nearby Stanton Bridge is traversed primarily by students, shoppers, and workers who reside in Ciudad Juarez and commute between the two border cities either by car or on foot. The Zaragoza International Bridge mostly carries two types of southbound traffic. One is cargo vehicles headed to maquiladora plants in the eastern quadrants of Ciudad Juarez or farther south in the state capital of Chihuahua City. The second is working professionals who commute to jobs on the opposite side of the border from where they reside.

Data utilized for this analysis are from three of the international bridges in the Borderplex: Santa Fe, Stanton, and Zaragoza. Monthly data gathered from the international bridges include the numbers of pedestrians, passenger vehicles, and commercial vehicles, plus the respective tolls paid by each group, between January 1991 and December 2004. Data utilized as explanatory variables include Ciudad Juarez maquiladora employment, Mexico Industrial Production Index, El Paso non-agricultural employment, United States consumer price index (CPI), and a real exchange rate index for the peso. Empirical analyses for the various traffic categories are completed using applied econometric time series procedures (De Leon, fullerton, and Kelley, 2009).

Empirical Outcomes

The first traffic flow analyzed is cargo vehicles utilizing the Zaragoza Bridge in the eastern part of the Borderplex. An increase in the toll leads to a decrease in cargo traffic within one month of implementation. Ciudad Juarez maquiladora employment, the Mexico industrial production index, and the real exchange rate are all positively correlated with cargo vehicle traffic on the Zaragoza Bridge. A devaluation of the peso leads to a rapid increase in cargo vehicle traffic. Importantly, the price elasticity calculated for this traffic category is -0.474, implying that cargo vehicle traffic on this bridge is not very sensitive to the tolls being charged. Comparative simulation exercises conducted for this traffic category are inconclusive. That means that accurate revenue forecasts and operations plans may difficult to achieve for cargo vehicle activity on this bridge.

Modeling results for Zaragoza Bridge passenger vehicles indicate that increases (decreases) El Paso employment, Ciudad Juarez maquiladora employment, and the Mexico industrial production index lead to increased (decreased) traffic volumes. Inflation adjusted tolls and the real exchange rate are negatively correlated with passenger vehicle traffic. That a weaker peso leads to a decrease in passenger vehicle traffic probably reflects the loss of

purchasing power experienced by Mexican shoppers who visit large shopping centers such as Cielo Vista Mall and Las Palmas Marketplace in East El Paso. The price elasticity of demand further indicates that passenger vehicle traffic on this bridge reacts very little to increases in the toll paid by cars. Forecast tests conducted for this bridge traffic category confirm a high degree of predictability for it.

The Stanton Bridge is located near Downtown El Paso. Passenger vehicle traffic flows across it are inversely related to changes in the real toll and exchange rate variables. In the case of the peso index, that result potentially reflects the proximity of this bridge to the downtown retail sector on the north side of the border. El Paso employment, Ciudad Juarez in-bond assembly employment, and the Mexico industrial production index are positively correlated with volume of cars that travel across the artery. As with the other traffic categories, the price elasticity indicates that the number of vehicles heading south across this structure is not very strongly affected by increases in the toll. In contrast, simulation results for this variable are much less reliable than those for passenger vehicles in East El Paso. That poses a challenge for revenue and operations planning for municipal authorities in charge of the bridge.

Large numbers of shoppers who cross on foot from Mexico return home over the Stanton Bridge. Not surprisingly, southbound pedestrian traffic flows on this bridge are inversely related to changes in the inflation adjusted values of the toll and the exchange rate. El Paso non-agricultural jobs, Ciudad Juarez maquiladora employment, and the Mexico industrial production index are all positively correlated with pedestrian traffic on the Stanton Bridge. Reaction times for this traffic category to changes in the explanatory variables are, similar to the other categories, fairly quick. However, as with southbound small vehicle flows across this structure, the forecasting exercises indicate that accurate predictions of foot traffic are hard to achieve.

The final category required to pay southbound tolls on the international bridges is pedestrian traffic on the Santa Fe Bridge. Pedestrian traffic is inversely related to changes in real toll along this second downtown bridge. For all other explanatory variables, the model coefficients carry positive signs. For the real exchange rate, that result is very different than that observed for the Stanton Bridge. It means that peso depreciation leads to an increase in foot traffic to the downtown Ciudad Juarez tourist district. This bridge is the one that most tourists from the United States use when they walk across the border. A stronger dollar probably attracts tourists who visit entertainment venues, restaurants, and shops, as well as medical tourists who are customers at the many health facilities and pharmacies located in this sector of Ciudad Juarez. As with both categories of tolled traffic on the Stanton Bridge, the simulation exercises indicate that accurate forecasts of southbound pedestrian flows on the Santa Fe Bridge will also be difficult to achieve.

The passenger and cargo vehicle price elasticities estimated for the international bridges that charge tolls on southbound traffic in magnitude to many of those reported elsewhere in the transport economics literature. One area in which some uncertainty remains is that comparative results for pedestrian reactions to changes in tolls have not been documented for other regions or borders. Similarly, there have relatively few out-of-sample simulation analyses conducted to examine the forecast reliability of bridge traffic econometric models. Results for the Borderplex tolled bridges indicate that accurate forecasts may only be achievable for structures where traffic

volumes are increasing. The mixed results call for some care to be used with regard to employing bridge traffic forecasts in public administrative exercises.

Policy Implications

Several of the results can potentially be of use to policy makers. Given that all five categories of bridge traffic are not very responsive to changes in the various tolls charged, rate increases will raise revenues without substantial reductions in volume usage. Although it would be politically, and diplomatically, difficult to use international bridges connecting the United States and Mexico as "cash cows," the City of El Paso should be capable of covering a substantial portion of current maintenance and future structural enhancement costs with the tolls charged. At one point, there was a 9-year period from November 1994 to December 2003 during which passenger vehicle tolls were left unchanged in nominal terms. There is no need to allow real erosion of the tolls to occur for such a long time. All three user fees can be adjusted more frequently without damaging the respective revenue streams.

Because the traffic flows are not very sensitive to toll increases, the tolls will not be of much use for congestion management. Given the rapid growth of international commerce in this region, plus the strong rates of population and economic expansion in the Borderplex, congestion on the bridges will remain problematic and affect business viability. That implies that more bridges, plus ongoing upgrades and enhancements to the existing structures, will be imperative if bottlenecks to growth are to be avoided. Fortunately, the results indicate that raising tolls provides one means for financing the infrastructure expansion and upgrades that will undoubtedly become necessary in future years. Because the price reactions are inelastic, raising tolls at the bridges will not, however, be very effective as a tool for reducing vehicle emissions via reduced traffic volumes. Greater bridge capacity that allows reducing border crossing times will be helpful in this regard.

All of the traffic categories respond within 60 days or less to toll rate changes. Cargo traffic across the Zaragoza bridge reacts in less than 30 days to variations in in-bond assembly payrolls and industrial production activity in Mexico. Staffing levels at that bridge will have very little time to be altered as Borderplex economic fortunes wax and wane with the North American business cycle. Similarly rapid responses also occur at all three bridges as consequences of variations in the currency value of the peso and non-agricultural employment in El Paso. Accordingly, flexible staffing schedules will have to be maintained in order to maximize efficiencies and revenues at these international exit points from El Paso.

Given the mixed outcomes for the comparative out-of-sample simulation results, the LTF models should be used with caution in municipal revenue forecasting endeavors. This is especially true for the two downtown international bridges that charges tolls on southbound traffic to Ciudad Juarez. At a minimum, traffic forecasts should be compared to recent historical observations as a means of providing "sanity checks" for the extrapolation results. During periods in which rate increases are enacted, policy analysts may elect to rely more heavily on the model simulations since those equations provide a quantitatively systematic manner for anticipating potential bridge usage impacts.

To date, the City of El Paso has only used fixed toll schedules. That is probably because much of the congestion observed on the international bridges is for northbound traffic heading into El Paso. That is principally due to more time consuming inspection practices historically applied by the United States at its ports of entry. It is possible, however, that Borderplex economic and demographic expansion may also lead to more binding capacity constraints on the southbound lanes of the tolled bridges. Under such a circumstance, variable congestion tolls might offer a partial mechanism for managing the greater traffic flow volumes and raising additional revenues for infrastructure expansion. The fixed schedules now in place, however, may be good choices for a regional road network already split in two by an international boundary.

Tolls remain a highly controversial topic in El Paso and the State of Texas as a whole. State government funding constraints increase the likelihood that some portion of the road network in El Paso may one day be funded with tolls. Econometric analysis of the long history of charging tolls on three of the international bridges indicates that local traffic behavior patterns are similar to those documented for other regional economies where such user fees are charged. Based on that, it seems logical that employing tolls to partially fund the street and highway grid in El Paso should meet with success.

Whether these results for southbound international bridge traffic are unique to El Paso is unknown at this point. Eventual comparative analyses for the other international bridges that charge tolls in Texas would be helpful. Obvious candidates include Laredo – Nuevo Laredo, McAllen – Reynosa, and Brownsville – Matamoros. Infrastructure financing constraints also pose obstacles to economic expansion in those metropolitan economies and empirical insight to the behavior of cross-border bridge traffic is likely of interest to business and policy analysts.

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