Border crossings from Mexico to the U.S. and the role of border homicides

André Varella Mollick¹ · René Cabral² · Eduardo Saucedo²

Accepted: 20 October 2021 / Published online: 19 November 2021

© The Author(s), under exclusive licence to Springer Nature B.V. 2021, corrected publication 2022

Abstract

This paper examines northbound crossings of personal vehicles and pedestrians from Mexico to the U.S. Sample size from January 1997 to December 2019 includes the period after December 2006 when then inaugurated Mexican government announced the “war on drugs”. We construct a series of border homicide share, which stands for the allocation of homicides in border states relative to the total of Mexican homicides. The series runs from between 15 to 20% to its peak of 48% in 2010 and its recent stabilization with less than 25%. We argue that this represents the intensity of violent crime spread throughout the Mexican border with the U.S., which is the geographic focus of research on border crossings. Employing structural vector autoregressions (SVAR), we estimate a model with homicide share, industrial production and border crossings. We compare the responses of this model to the pure economic model with the real exchange rate. We conclude that the response of border crossings to shocks in industrial production is about the same (positive and statistically significant) across models. However, while border crossings of vehicles and pedestrians respond negatively to positive shocks in border homicides the response of vehicles is prolonged and for pedestrians is immediate.

JEL Classification Numbers F16 · F22 · F31 · R12

✉ Eduardo Saucedo
eduardo.saucedo@tec.mx

André Varella Mollick
andre.mollick@utrgv.edu

René Cabral
rcabral@tec.mx

¹ Department of Economics, University of Texas Rio Grande Valley, 1201 W. University Dr, Edinburg, TX 78539-2999, USA

² EGADE Business School, Tecnológico de Monterrey, Ave. Rufino Tamayo, CP. 66269 Garza García, NL, Mexico

Introduction

The flow of people and merchandise between Mexico and the U.S. has grown dramatically in recent years. According to the Census Bureau, in 2019 Mexico surpassed China and Canada as U.S. top trading partner. In terms of international visitors, with 22.9% of the total I-94 forms (18.1 million), Mexico was in 2019 the second origin of visits to the U.S., just after Canada which accounted for 26.1% of the total visits (U.S. National Tourism and Travel Office, 2020). This compared with only 9% of the total I-94 forms issued to Mexican residents in 2000 (32% to Canadian residents). With more than 49 million crossings in 2019, Mexican residents register nearly 50 times more pedestrian crossing to the U.S. than Canadian residents (Bureau of Transportation Statistics, 2020). All these figures suggest a fast forward trend in economic and social integration between the U.S. and Mexico despite the existing evidence that tourism visits and immigration bring also higher crime rates (Mehmood et al., 2016).

Trends of northbound border crossings from Mexico to the U.S. vary markedly across categories. Figure 1 displays personal vehicles and pedestrians for these two categories of border crossings between January 1997 and December 2019. On the nature of pedestrians and passenger vehicles crossings, we realized that these are mostly motivated by work, shopping, and leisure activities. Although the traveller's location might not be certain, workers legally crossing the border every day most likely live nearby in border towns and cities. Meanwhile, shopping and leisure crossings could be carried out by locals but also by people living in the rest of Mexico. The nature of pedestrian and vehicles crossings is thus not a straightforward phenomenon, and the effects of crime on these flows become a complex matter.

Fig. 1 Personal Vehicle and Pedestrians Crossings from Mexico to the U.S. Source: Author's estimations using data from Bureau of Transportation Statistics

This paper provides an assessment of the impact of crime in Mexico on north-bound border crossings along the U.S.-Mexican border. Following the nonstopping economic and social integration trends between the U.S. and Mexico described above, the study tries to respond to whether crimes has negatively affected the legal crossing of pedestrian and personal vehicles moving across the U.S. Mexican border. This question is relevant since both kinds of crossings are essential for economic activities such as work, shopping and leisure (see, among others, Skoll, 2011; Sullivan et al, 2012; and Fullerton & Walke, 2019).

Crime in this article is captured as the ratio of homicides along the Mexico—U.S. border relative to total homicides in Mexico. This measure, which we refer to as border homicide share, first increases steadily following the “war on drugs” undertaken in Mexico and then decreases, in line with more stabilization of violent crime more recently in the 6 Mexican states bordering the U.S. In order to verify the content of the economic model with the real exchange rate and industrial production as major determinants of border crossings, we introduce the homicide share in a hybrid model of border crossings. In this, economic activity in Mexico (industrial production) follows homicides as an alternative framework for identifying what makes personal vehicles and pedestrians move north across the ports of entry (POE).

Previous work for Mexican border crossings by Cabral et al. (2019a) reports significant exchange rate effects on personal vehicles using panel data across several POEs, controlling for output growth and labor market conditions in the neighboring city in the U.S. Less established is how other types of border-crossing than personal vehicles vary with economic conditions. There has also been burgeoning evidence on increasing crime in Mexico, and especially at the Mexico-U.S. border, to re-focus interest of social effects on border crossings. Burns (2019), for instance, suggest that “illegitimate entities such as money laundering, drug trafficking, contraband, and human trafficking cartels strategically select busy ports of entry and high traffic times in order for illegitimate trade and travelers to penetrate the U.S. border”. Also, Woosnam et al. (2015) explore tourists’ perceived safety at two different points across the U.S.-Mexican border, which may be more or less affected by violence originated across the Mexican side. Ritchie et al. (2010) consider that drug violence along the U.S. – Mexico border has not deterred international visitors coming to Mexico because even though drug cartels are extremely dangerous, they never attack people that are not involved in their affairs or in drug trafficking. In contrast, Simpson et al. (2014) analyze the effect that Mexico “narco-violence” happening on U.S.-Mexico border areas could be exerting on the decision of regular winter migrants that every year travel into the South Texas area that borders on Mexico. They report that fear of perceived crime and violence affects satisfaction and the intention to return to such destination. Notice that this paper does not explain crime, which itself is part of another vast literature. Given this background on travel studies along the Mexico-U.S. border, our paper takes into account the incidence of crime along the border in our estimates of northbound flows from Mexico.

As for the literature that has analyzed the determinants of crime (crime offences in a local government area over population), for example, Bun et al. (2020) report dynamic panel data methods for Australia from 1995/96 to 2007/08. In the context of Mexico’s incidence of crime among its regions, Murphy and Rossi (2020) use

economic history and Chinese establishments to study the origins and consequences of Mexican drug cartels.

We construct an indicator we call the border share of homicides: the number of homicides in the six border Mexican states with the U.S. divided by total homicides in Mexico. The idea of constructing this indicator is to capture the relative impact of crime on people's willingness to cross the border. The relative level of violence is particularly relevant for people not living in border cities. For example, we anticipate that travellers crossing the border for shopping and leisure activities might be less eager to travel to the U.S. when violence is relatively higher on the border than in their location. The homicide trends in Mexico, illustrated below, highlight the steep increase in homicides concentrated along the Mexico-U.S. border states at the peak of the "war on drugs". This is also consistent with increasing types of violent crime (homicides), generally associated with drug trafficking organizations (DTOs). Sobrino (2020) documents that the increase in violence experienced by Mexico has been due to criminal groups fighting for the market share of heroin, not only due to changes in government enforcement.

Ongoing research has suggested the effects of crime and violence on economic activity and society are negative and significant. Cabral et al. (2016) document the negative effects of crime on labor productivity for panels of Mexican states. Utar (2018) and Dell (2015) investigate the labor market and firm responses to increasing violence. Bel and Holst (2019) show that the growth in the number of homicides has negative and statistically significant effects on Mexican state GDP growth from 2003 to 2013. Cabral et al. (2019b) report the effects of various types of crime (including homicides) on FDI inflows to Mexican states. Crime may have effects on socio indicators as well. Michaelsen and Salardi (2020) report the effects of violence (and psychological stress) on the educational performance of test scores during the "war on drugs" in Mexico.

There exists a large body of evidence on terrorism and its impact on U.S. FDI: e.g., Enders et al. (2006) for a time series approach, including the effects of 9/11. Brown (2015) report evidence of border thickening and suggest that the increase in waiting times, following the more extensive security checks, as well as the cost of additional border regulations doubled the premium paid to move goods across the border. Seabra et al. (2020) investigate the connection between terrorism and tourist activities with unrestricted VARs after identifying unidirectional causal relationship between terrorist attacks and tourism arrivals in Portugal from several destinations. Our study applies vector autoregressions to the literature on transportation and border crossings from Mexico to the U.S.

For the U.S.–Mexico border, Fullerton and Walke (2014) show that a real depreciation of the peso relative to the U.S. dollar increase retail sales in Mexican cities and higher levels of unemployment in nearby U.S. cities. Panel data estimations by POEs reported by Cabral et al. (2019a) provide a set of results: changes in the Mexican peso have negative and statistically significant effects on northbound crossings, and that vehicle border crossings increase when the Mexican economy grows faster than the U.S. economy and when unemployment across the U.S.–Mexico border declines. Orraca-Romano and Vargas-Valle (2020) regress the outcome variable (1 if a worker is a cross-border commuter and 0 otherwise) on homicide rates per 1,000

in Mexican municipalities, as well as the proportion of the municipality's workers or working-age population employed in the U.S. living in municipality in a given year. They find negative effects of homicide rates on the outcome variables using fixed-effects models. These are consistent with drug-related violence and the decline in the number of Mexican cross-border workers. There is more evidence for the transportation linkages between Canada and the U.S., yet not using crime or violence indicators.¹

We adopt a structural vector autoregressive (SVAR) model to address the question of whether crime has had any effect on crossings of pedestrian and personal vehicle crossings with minimum identifying assumptions at monthly frequency. We build the border homicide share, which captures the allocation of homicides in border states relative to the total of Mexican homicides. Throughout the sample period, the series move from between 15 to 20% to 48% in 2010 and stabilize in the more recent years below 25%. We argue that this represents the intensity of violent crime spread throughout the border with the U.S. We estimate a hybrid model with homicide share, industrial production and border crossings. We then compare the responses from this model to the pure economic model with changes in the real exchange rate, industrial production and crossings. Our key results are as follows. First, personal vehicles respond negatively to innovations in homicide share: -0.004 in response to a positive structural shock to the homicide share, which remains negative and significant for some months. Pedestrians respond on impact at month 1 (-0.015) and in the second and third months (-0.010 and -0.007). We contrast these to the model with only economic forces and conclude that the response of crossings to economic activity is about the same. Still, border crossings respond negatively more to shocks in homicide share than to shocks in the real value of the peso against other currencies.

The plan of the paper is as follows after this Introduction. Section 2 analyzes the variables included in this study. Section 3 describes the empirical models, and Sect. 4 reports the main findings in the econometric models. The last section of the paper offers concluding remarks.

Data analysis

Cabral et al. (2019a) use monthly data for each of the 25 border POE along the U.S.-Mexico border and rank border crossing points from number 1 (the busiest POE) to number 25 (the least-busy POE). In this paper, we investigate our research question at the aggregate for Mexico, looking instead at two different types of northbound border crossings: personal vehicles and pedestrians.² Although there is evidence

¹ Previous works on Canadian-U.S. border crossings include: Di Matteo and Di Matteo (1996); Anderson et al., (2014); Chandra et al. (2014); Avetisyan et al. (2015); Maoh et al., (2016, 2018); Chen et al. (2017); and Baggs et al. (2018).

² An earlier version of this paper included personal vehicles, pedestrians, and truck crossings. However, the series of trucks is dropped because their historical trend-like pattern is very different from the behaviour displayed in Fig. 1 for the two series of interest in this paper. Therefore, we conjecture that truck

Fig. 2 Real Exchange Rate Index (ITCR in Mexico) from 1997 to 2019. December 2010=100 (Real Exchange Rate). Source: Author's estimations using data from Banxico, INEGI and BLS

that southbound border crossings have less variability and thus are more predictable (Garrido, 2000), our interest here is to assess the impact of crime originated in Mexico on cross border traffic flows.

Figure 1 shows these series in levels with time-varying from January of 1997 to December of 2019. Crossings of pedestrians and personal vehicles resemble their overall patterns.

Figure 2 shows the real value of the Mexican peso against a large basket of currencies. The index is set at 100 in December 2010, and an increase represents a real depreciation of the peso. There is a real appreciation until March 2002 (with a value of 69.68) and then depreciation.

Figure 3 shows for Mexico the Global Indicator of Economic Activity (IGAE), a monthly indicator of the country's economic activity, which is plotted against the U.S. Industrial Production Index measuring U.S. economic activity at monthly frequency. There is synchronicity in the two economies. Yet, in the 2001 mild recession in the U.S., Mexico's IGAE does not move much, except at the end. On the other hand, for the more severe 2007–2009 recession in the U.S., Mexican IGAE starts to fall with some delay, in November 2008 (relative to July 2008 for the U.S. industrial production index), it does that less sharply and recovers more quickly.

Using homicide data in Mexico, shown in Fig. 4, we construct a series of border homicide share, which stands for the allocation of homicides in border states relative to the total of Mexican homicides.

The series in Fig. 5 runs from between 15 to 20% to its peak of 48% in August 2010 and to a more recent stabilization with less than 25%. This represents the

Footnote 2 (continued)

crossings are perhaps less sensitive to border crime and leave an explanation of the behaviour of truck crossings for future work.

Fig. 3 Industrial Production Indices (IGAE and INDPRO) from 1997 to 2019. Source: Author's estimations using data from INEGI and Federal Reserve St. Louis

intensity of violent crime spread throughout the Mexican border with the U.S.: first very stable with border homicides at less than 20% of Mexico, then moving sharply up and down.

Table 1 provides descriptive statistics in growth rate form. The mean of the real exchange rate growth (Δ ITCR) is close to zero, the standard deviation is at 0.026, and minimum and maximum monthly growth rates vary between -0.077 and 0.134. Average growth of Mexican real industrial activity (Δ IGAE), using the IGAE index, is higher than U.S. economic activity (Δ INDPRO) with mean monthly growth rates of 0.002 versus 0.001 and higher standard deviation

Fig. 4 Homicides in Mexico, in Mexican 6 border states with U.S., and in border municipalities in 6 border states from 1997 to 2019. Source: Author's estimations using data from INEGI

Fig. 5 Share of homicides in 6 Mexican border states with U.S. to total 32 Mexican states (HOMSHARE) from 1997 to 2019. Source: Author's estimations using data from INEGI

in Mexico (0.031) versus the U.S. (0.007), as well as maximum and minimum growth rates in Mexico of 0.083 and -0.076, compared to 0.021 and -0.043 in the U.S. The mean growth rate of the share of Mexican border states in total homicides (Δ HOMSHARE) is 0.009 and highly volatile with a standard deviation of 0.121 and max values of 46.7% and min of -23.8%. The main series of interest representing types of border crossings show some similarities: mean growth rates are 0.3% in personal vehicles and 0.6% in pedestrians, with standard deviations of 0.06 and 0.09, respectively. Furthermore, maximum growth rates over the sample vary from 37% in personal vehicles to a minimum of -26%.

Table 2 displays the correlation coefficients among the main series. Changes in TCR correlate negatively with crossings, especially for -0.10 between growth rates of TCR and growth rates in personal vehicles (with *t* statistic of -1.74 of zero correlation coefficient). There is a strong positive correlation between changes in IGAE and border crossings, varying from 0.43 in pedestrians to 0.54 in personal vehicles. We also conclude from Table 2 that cross-border flows correlate negatively with homicides at the border: varying from -0.025 with personal vehicles to -0.126 with pedestrians, the latter is statistically significant.

Table 1 Descriptive Statistics

	Δ TCR	Δ IGAE	Δ INDPRO	Δ HOMSHARE	Δ VEHICLES	Δ PEDESTRIANS
Mean	7.39E-05	0.0023	0.0011	0.0089	0.0027	0.0056
Median	-0.0010	-0.0029	0.0014	-0.0071	-0.0052	-0.0041
Maximum	0.1341	0.0828	0.0205	0.4661	0.3650	0.2859
Minimum	-0.0770	-0.0761	-0.0433	-0.2375	-0.2571	-0.2010
Std. Dev	0.0260	0.0309	0.0065	0.1208	0.0634	0.0922
Observations	275	275	275	275	275	275

Source: Author's estimations.

Table 2 Correlation Matrices

Correlation						
t-Statistic	Δ TCR	Δ IGAE	Δ INDPRO	Δ HOMSHARE	Δ VEHICLES	Δ PEDESTRIANS
Δ TCR	1.0000					
	—					
Δ IGAE	0.036 (0.60)	1.000 —				
Δ INDPRO	0.005 (0.094)	0.043 (0.71)	1.000 —			
Δ HOMSHARE	0.13 (2.23)	-0.106 (-1.76)	0.082 (1.36)	1.000 —		
Δ VEHICLES	-0.104 (-1.73)	0.544 (10.73)	0.106 (1.77)	-0.024 (-0.40)	1.000 —	
Δ PEDESTRI- ANS	-0.126 (-2.10)	0.429 (7.85)	0.137 (2.29)	-0.125 (-2.09)	0.720 (17.1)	1.0000 —

Source: Author's estimations.

The empirical models

Preliminary inspection of cointegration by Johansen system methods does not detect cointegration among the series.³ The series in levels are transformed into monthly growth rates, which make them all stationary around zero. All series were tested in levels and in growth rates to identify the presence of unit roots. Augmented Dickey Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests are used. Results among all tests are consistent to indicate that all series are non-stationary in levels, but once they are transformed into growth rate levels all of them become stationary.⁴ We will proceed with the series in growth rates, which satisfies the stationary assumption in time series and for the particular methodology based on impulse responses and variance decompositions.

³ Results are as follows for Johansen cointegration tests with intercept (no trend) in cointegrating equation. In only one of the 4 cases, there is rejection of the null hypothesis of no cointegration. For the model with homicides, IGAE and personal vehicles, trace statistics is 32.60 (greater than critical value 5% of 29.80) for the null of no cointegrating vectors and 2.94 (lower than critical value 5% of 15.49) for the null of at most 1 cointegrating vector. Maximum eigenvalue test statistics is 29.66 (greater than critical value 5% of 21.13) for the null of no cointegrating vectors and 2.59 (lower than critical value 5% of 14.26) for the null of at most 1 cointegrating vector. For the model with homicides, IGAE and pedestrians, trace statistics is 25.39 (lower than critical value 5% of 29.80) for the null of no cointegrating vectors and 5.06 (lower than critical value 5% of 15.49) for the null of at most 1 cointegrating vector. Maximum eigenvalue statistics is 20.33 (lower than critical value 5% of 21.13) for the null of no cointegrating vectors and 4.46 (lower than critical value 5% of 14.26) for the null of at most 1 cointegrating vector. For the model with the real exchange rate (instead of homicide share) in both pedestrians and personal vehicles the null of no cointegration cannot be rejected.

⁴ Table with all unit root econometric tests and figures in growth rate levels are available upon request.

Before estimation of the 3-variable structural VAR (SVAR), we run pairwise Granger causality tests. Table 3 reports these results for 13 lags. There is unidirectional causality from border homicide share to changes in IGAE (F-statistics of 3.52 with a p-value of 0.00); the other way around has F-statistics of 1.27 with a p-value of 0.23. There is no causality, however, from growth rates in the real exchange rate to growth rates in IGAE and vice versa with p-values of both at 0.21 and 0.39, respectively. The data are therefore more consistent with pair causality going from growth rates of homicides to growth rates in industrial production and less favorable to the small open economy hypothesis that economic activity responds to the real value of the local currency against a basket. The relationships between IGAE and personal vehicles crossings is bidirectional. The relationships between homicide share and personal vehicles is not statistically significant in any direction. All types of border crossings are bidirectional when estimating one against the other and vice versa. Estimations of Granger causality at 12 lags are very similar.

The empirical model implemented is the structural VAR (SVAR), in which all series are endogenous and respond to lags of its own and of the others. The causal ordering with identifying assumptions goes from external forces in the goods and currency markets (growth rates in the TCR, Δ ITCR, meaning the well-known title of the index of real exchange rate in Spanish: “índice de tipo de cambio real” (ITCR)) to domestic economic factors (growth rates in IGAE, the index of industrial production in Mexico). This is consistent with the small open economy hypothesis: a weaker real value of the domestic currency stimulates real domestic output through the effect of net exports: higher exports and lower imports.

For the simplest SVAR with 3 economic series, the monthly changes in personal vehicles is affected by the sum of the first two structural shocks (e1 from the currency markets and e2 from goods and services) and its own (e3). This means that the innovation in TCR is entirely the result of the external shock. The second row in the system states that innovation in real output is the result of two shocks: the first one from TCR and the second, a shock to real output (“a productivity” shock). The third row represents the most endogenous, the northbound crossing of personal vehicles (or pedestrians) to the U.S., which responds to innovation in TCR, in real output, and in its own volume of border crossings.

The SVAR is as follows:

$$A_0 Z_t = c + \sum_{i=1}^{14} A_i Z_{t-i} + \varepsilon_t \quad (1)$$

In (1), $Z_t = (\Delta \text{TCR}_t, \Delta y_t, \Delta \text{crossings}_t)$, where Δ represents the monthly growth rates of all three series: $\Delta x_t = (x_t - x_{t-1})/x_{t-1}$. This is the pure economic model with growth in currency real depreciation or appreciation, growth in real output and growth in border crossings.

In an alternative model, $Z_t = (\Delta \text{homshare}_t, \Delta y_t, \Delta \text{crossings}_t)$, where the most exogenous series is the share of homicide rates in states bordering the U.S. This depends on social factors and government interventions to control DTOs. The third row in this socio-economic model indicates that innovations in cross-bordering traffic are the result of three shocks: the first one from the share of homicides at border

Table 3 Pairwise Granger Causality Tests

Null hypothesis	F-stat. [Prob]	Null hypothesis	F-stat. [Prob]
Δ IGAE does not GC Δ TCR	1.07 [0.39]	Δ TCR does not GC Δ IGAE	1.31 [0.21]
Δ HOMSHARE does not GC Δ TCR	0.79 [0.67]	Δ TCR does not GC Δ HOMSHARE	2.06 [0.02]
Δ VEHICLES does not GC Δ TCR	1.51 [0.11]	Δ TCR does not GC Δ VEHICLES	1.61 [0.08]
Δ PEDESTRIANS does not GC Δ TCR	1.84 [0.04]	Δ TCR does not GC Δ PEDESTRIANS	1.23 [0.26]
Δ HOMSHARE does not GC Δ IGAE	3.52 [0.00]	Δ IGAE does not GC Δ HOMSHARE	1.27 [0.23]
Δ VEHICLES does not GC Δ IGAE	3.53 [0.00]	Δ IGAE does not GC Δ VEHICLES	2.23 [0.01]
Δ PEDESTRIANS does not GC Δ IGAE	2.72 [0.00]	Δ IGAE does not GC Δ PEDESTRIANS	3.06 [0.00]
Δ VEHICLES does not GC Δ HOMSHARE	1.06 [0.40]	Δ HOMSHARE does not GC Δ VEHICLES	1.68 [0.07]
Δ PEDESTRIANS does not GC Δ HOMSH	1.84 [0.04]	Δ HOMSHARE does not GC Δ PEDESTRIANS	0.98 [0.48]
Δ PEDESTRIANS does not GC Δ VEHICL	2.69 [0.00]	Δ VEHICLES does not GC Δ PEDESTRIANS	2.04 [0.02]

Notes: Rejections of the null hypothesis at 5% level or lower appear in bold. Lag-length is 13 and N is 262 at monthly frequency.

Source: Author's estimations.

states compared to the total of Mexico (HOMSHARE is the raw series in Fig. 5), the second to real output, and the third to own innovations to border crossings. This means that our empirical model is of low dimension (3 series), which makes simple the interpretation of the shocks: crime will have an effect on the real economy (economic activity measured by industrial production) and also on border crossings. However, shocks to crime are due to its own dynamics since it pertains to the violence and incidence of crime along the Mexico-U.S. border, possibly driven by DTOs. A useful set-up with 3 equations for the world economy is Kilian (2009), whose first innovation is of the global oil production, which responds to its own supply disruptions; the second is real economic activity, which responds to its own innovations plus those from global oil supply; and the third series (the real price of oil) responds to all 3 structural innovations. Here we have crime (measured by homicides in Mexican border states with U.S. border), industrial production, and border crossings.

Following the literature on time series macroeconomics by Hamilton and Herrera (2004), Güntner and Linsbauer (2018), and others, we include initially 12 lags in the model and then check for 13 or 14 lags based on information criteria and serial correlation LM tests. The approach at monthly frequency allowing a sufficient number of lags is able to account for seasonality and for the usual lagged responses of macro variables to exogenous forces, such as currency (in the economic model) or homicide share (in the hybrid model).

Following Cabral et al. (2019a) for border crossings of personal vehicles under panel data, we include exogenous variables in the VAR. They are a dummy variable for U.S. recessions as documented by NBER (1 for recessions from March 2001 to November 2001 and from December 2007 to June 2009; 0 otherwise)⁵; and another to register the impact of terrorist effects on border crossings: 1 from September 2001 onwards, and 0 otherwise. NBER dummy has negative effects on Mexican IGAE and on border crossings; September 2001 dummy has negative effects on border crossings, particularly for personal vehicles and pedestrians. Adjusted R^2 s of unrestricted VARs with optimal 13 or 14 lags are close to 80% for growth rates in industrial production and close to 20% for growth rates in shares of border homicides; between 6 and 15% for growth rates in real Mexican currency.

After estimations of unrestricted VARs, we then test for serial correlation in the residuals using the LM test under the null that there is no serial correlation.⁶ In (1), c is a 3×1 vector of constant terms, A_0 is a 3×3 matrix of unknown coefficients,

⁵ An anonymous Referee asked “is there any reason to consider an alternative measure (namely, unemployment rates at the border) as a better way to capture economic activity in the U.S.? Are the results robust to this more dynamic, local measure? In this paper, contrary to Cabral et al., (2019b, 2019a), who used unemployment rate in U.S. MSAs for ports of entry (POEs), we are faced with evidence for the aggregate of Mexican northbound border crossings. Therefore, it would be difficult to use a single labor market measure because unemployment rates vary significant at POEs. This explains why we take industrial production measures indicating the overall state of the two economies at monthly frequency (Fig. 3 displays both movements). Our Fig. 1 contains the two series of interest of border crossings, which are for the aggregate of Mexico and not for POEs as did Cabral et al., (2019b, 2019a) for panel data.

⁶ Diagnostics for serial correlation LM tests are included in Tables below for the final SVAR model used in each case.

and ε_t is a column vector of errors with orthogonal innovations per the identification procedure. The block recursive structure allows us to report meaningful impulse responses associated with one-standard error innovation of the structural shocks with the confidence bands generated by 5,000 Monte Carlo replications. The model is exactly identified with $n(n-1)/2 = 3$ restrictions, where n is the number of endogenous variables (3 in both models). See Rubio-Ramírez et al. (2010) for other examples of identifying restrictions, including global identification of SVARs. Restrictions are imposed to transform VAR errors that are uncorrelated structural shocks. We check below variance decompositions generated by factor decompositions in two ways: first by using the standard recursive factorizations (A unit triangular and B diagonal of the matrices linking the reduced form errors to structural errors); and second by recursive (triangular) long-run restrictions on the impulse responses. Lütkepohl et al. (2018) consider the standard decomposition and alternatively impose long-run restrictions on the total impact multiplier matrix of IRFs. Based on their Monte Carlo experiment comparing the precision of the two approaches, they conclude: “In summary, if one is interested in the long-run effects of structural shocks, using long-run restrictions can result in more precise estimates. The gains in estimation precision are especially large for persistent processes, and they can also be substantial if the true DGP is an infinite-order VAR process.” Lütkepohl et al., (2018, p. 239).

In (1), the dependent variable “Crossings” stands for the number of passenger vehicles or pedestrians traveling northbound through all POE along the U.S.–Mexico border from January 1997 until December 2019. Both monthly flows should respond negatively by increases in TCR since a weaker peso makes the purchasing power of the Mexican currency lower in the U.S. On the other hand, both flows should respond positively with increases in domestic output, since higher income leads to higher travel due to more affordability for leisure and shopping activities across the border.⁷ Traffic at the border ports of entry may also respond to the level of violence in states at the Mexico-U.S. border states. Seabra et al., (2020, p. 2) review the literature on terrorism and tourism and note that “safety is clearly one of tourists’ main concerns. It is a basic human need...” We, therefore, expect an increase in homicides at border states should decrease the level of cross-border crossings, although it is an open question whether the impact is immediate or with lags.

Equation (1) introduces the model’s dependent and independent variables in growth rates, to satisfy estimation of stationary variables that are not cointegrated. Previous works on border crossings, such as Anderson et al. (2014), Maoh et al. (2016) and Cabral et al. (2019a) contain their explanatory variables in percentage changes in the nominal exchange rate and in actual growth rates of the economy. Cabral et al. (2019a) investigate the real exchange as the main variable in their panel data setting, while allowing for unemployment at U.S. border cities and industrial

⁷ Following McKercher et al. (2008), it is expected that most of pedestrians and personal vehicles coming into the U.S. come from Mexican neighbor border cities, as distance decay theory suggests that demand for any good or service should decline exponentially as distance increases. While daily legal work-related crossing, and even temporary and permanent migration, might reduce when the Mexican economy grows, we expect the net effect on crossings to be positive.

production changes. In this paper, we look at feedback from the TCR to domestic output through the small open economy argument, which then stimulates north-bound crossings. In the alternative model, worsening conditions of violent crime in Mexican states bordering the U.S. leads to weaker economic growth and then to a different pace of border crossings. What we have in this paper is that when the Mexican economy is growing, border crossings of pedestrians and personal vehicles should increase. While the pure economic model relies on currency markets, the hybrid socio-economic model allows for violence in states of the border preceding economic conditions and then border crossings.

Results

As it was previously mentioned, all series become stationary around zero mean once they are transformed into growth rates. For the unrestricted VARs with three equations with 13 or 14 lags, depending on serial correlation LM tests, we add two dummy variables as deterministic terms (NBER dummy for the two U.S. recessions over this period) and the trend term).⁸ For the SVARs with DHOMSHARE as first series with growth rates of border homicide trends, the adjusted R^2 statistics of the homicide equations vary from 20% (vehicles) to 22% (pedestrians), of the industrial production (IGAE) equations the value is 78% in the case of vehicles and pedestrians, and of crossings is 72% in the case of vehicles. For the SVARs with DTCR as first series with growth rates of real value of the peso, the adjusted R^2 statistics of the TCR is 6% in the case of vehicles, of the industrial production (IGAE) equations is 76% for pedestrians, and of border crossings is 73% for vehicles and pedestrians.

Following common practice, we investigate the dynamic responses in more detail to be able to rationalize our main findings. Figure 6 contains the accumulated impulse response functions (IRFs) of the SVAR model generated by [Δ HOMSHARE, Δ IGAE, and Δ VEHICLES], following the Wold ordering discussed in Sect. 3. We investigate both the standard set on restrictions as well as long-run restrictions on the IRFs directly. Since the variables are expressed in growth rates, the dynamic analysis employs accumulated impulse-response functions as suggested by Lütkepohl et al. (2018): “Cumulated impulse responses are typically of interest when y_t contains growth rates of economic variables. Imposing a zero restriction on the cumulated long-run effect of a shock on a growth rate implies that the underlying variable in the long-run will return to its initial value where it has come from before the shock occurred. Such a restriction indirectly constrains the impact effects of the shocks and, hence, can be used for identifying the structural shocks.” Lütkepohl et al., (2018, p. 232).

⁸ The deterministic trend is included since the three series appear to have declining trends (vehicles and pedestrians) from Fig. 1. In general, the trend is not found to be statistically significant in the VARs. On the other hand, with border homicides, the NBER dummy is always statistically significant: positive for homicide shares, and negative for both industrial production and crossings growth rates. In response to lower economic activity in the U.S., Mexican industrial production and border crossings decline, all else constant. The 9/11 dummy shows up as statistically significant in some equations, with negative effects on border crossings or positive effects on the real exchange rate.

Fig. 6 Figures of IRFs Economic Model for Personal Vehicles with Δ HOMSHARE first, followed by Δ IGAE, and Δ VEHICLES last (with recursive long-run restrictions on Impulse Responses) Accumulated Response to Structural VAR Innovations $\pm$ 2 S.E. Note: The dashed lines correspond to the confidence intervals. Source: Author's estimations

Shock 1 pertains to innovations in border share of homicides, Shock 2 to innovations in Mexico's economic activity and Shock 3 to own innovations in personal vehicles. This is in model (1) with homicides. Similar interpretation holds for the economic model of the small-open economy when growth rates of the real value of the Mexican peso precede output and then border crossings. Shock 1 in Fig. 6 for personal vehicles reports a statistically significant negative response on impact: -0.004. There are also negative responses, which are statistically significant at -0.007 as indicated by the confidence bands generated by Monte Carlo simulations at lags 5, 6, 7 and 8. Shock 2 in Fig. 6 reports a statistically significant positive response on impact, within the month of the shock, estimated at +0.005, which is statistically significant. These are both economically meaningful. First, the one percent increase in innovations to homicides at states of the border leads to a reduction of personal vehicles of -0.7%, which is statistically significant and will remain so for a few months. Second, the one percent increase in innovations to Mexican economic activity leads to an immediate increase in northbound traffic of personal vehicles of +0.5%.

When we inspect the effects on pedestrians in Fig. 7, we revert to negative responses by people crossing the border: there is in the upper figure statistically significant negative response on impact (-0.015), which stays negative at months 2 (-0.010) and 3 (-0.007). It then reverts to zero. These short-term responses are statistically significant, as indicated by the Monte Carlo generated confidence bands. The interpretation is that pedestrians cross the border less with positive shocks in border homicide share: increases in innovations to crime along the border make pedestrians cross the border less on impact. The size and duration of such negative effect is, however, considerably larger on impact but also shorter-lived than in the case of vehicles.⁹

⁹ This finding might be due to the different nature of both types of crossings. While most pedestrians live in border cities and cross to the U.S. every day for work or essential shopping, drivers of passenger vehicles may live away from the border. These visitors travel to the U.S. for shopping and leisure and may be more concerned about crime happening at the border, which may explain the prolonged effect and not only on impact.

Fig. 7 Figures of IRFs of Economic Model for Pedestrians with Δ HOMSHARE first, followed by Δ IGAE, and Δ PEDESTRIANS last (with recursive long-run restrictions on Impulse Responses) Accumulated Response to Structural VAR Innovations ± 2 S.E. Note: The dashed lines correspond to the confidence intervals. Source: Author's estimations

Figures 8 and 9 present the IRFs for the pure economic model, where growth rates in real exchange rates precede economic activity and then border crossings. The SVAR model has [DTCR, DIGAE, and DVEHICLES].

Figure 8 for personal vehicles has responses that are quite different from the model with border homicides, yet only on impact: +0.008 to shocks in TCR, a positive shock to the real value of the Mexican peso (i.e., a peso depreciation) leads to a positive impact on crossings towards the U.S., which goes against our expectations.¹⁰ We also see a much weaker positive response to domestic economic activity (shock 2) only on impact at +0.0033, which is barely significant given the standard errors estimated at 0.0019. For pedestrians in Fig. 9, the results are very similar to the previous model as far as the response to innovations in border homicides: pedestrian border crossings decline by -0.015, -0.010 and -0.007 in the first three months, all statistically significant responses.

There are no visible responses to economic activity, however. Overall, there are fewer responses that are economically and statistically significant than the model with border homicides. There is also one puzzling response: border crossing of vehicles increase with positive innovations to the real value of the peso (towards weaker peso, stronger dollar), although this remains only in the first month and return to zero soon after.

The variance decompositions appear in Tables 4 and 5 for each type of border crossings. The statistically significant responses are in bold. The left panel of Table 4 has the model with border homicide shares, and the right panel has the model with real exchange rates. Shocks in border homicide share explain close to 12% of industrial production fluctuations in Mexico (IGAE) at 12 months, and shocks in IGAE explain 6.5% of vehicle border crossings at 12 months. For the right panel, shocks in

¹⁰ In the case of the U.S.-Mexico border, Gibbons and Fish (1987) note that some researchers propose that the Mexico price level does not affect border travel, while others suggest that even slight changes in relative prices are reflected in border transactions. In the case of the U.S.-Canada border, Di Matteo and Di Matteo (1993) mention that the exchange rate is a key determinant of expenditures by Canadians visiting the United States.

Fig. 8 Figures of IRFs Economic Model for Personal Vehicles with Δ TCR first, followed by Δ IGAE, and Δ VEHICLES last (with recursive long-run restrictions on Impulse Responses) Accumulated Response to Structural VAR Innovations ± 2 S.E. Note: The dashed lines correspond to the confidence intervals. Source: Author's estimations

IGAE explain close to 9% of vehicle border crossings at 12 months. Note also that innovations in the real exchange rate have no effect on the variance decomposition of IGAE since value is 5.09 with standard deviation of 3.27.

Overall, the variance decompositions in Tables 4 and 5 do not show many changes on border crossings when DHOMSHARE is the most exogenous series in the SVAR, compared to when DTCR is the most exogenous series in the traditional small open economy model. The tables do coincide, however, that either homicide share or the real exchange rate are mostly exogenous of the three series since in both cases these factors are mostly explained (between 92 and 94%) by their own structural shocks.

An earlier footnote (#7) indicated the statistical significance of the dummy variables, especially for the NBER dummy in influencing border crossings from Mexico to the U.S. Since the dummy variable of 9/11 was statistically significant only for crossings and not for the other two equations, we reestimate the SVAR without 9/11 as exogenous variable. As expected, the changes are only marginal: the response of crossings to shock 1 (homicides) becomes -0.005 at first month (compared to -0.004

Fig. 9 Figures of IRFs Economic Model for Pedestrians with Δ TCR first, followed by Δ IGAE, and Δ PEDESTRIANS last (with recursive long-run restrictions on Impulse Responses) Accumulated Response to Structural VAR Innovations ± 2 S.E. Note: The dashed lines correspond to the confidence intervals. Source: Author's estimations

Table 4 Variance Decompositions of (1) of Personal Vehicles Border Crossings

Innovations	Innovations		Innovations →		Innovations	
	Shocks in	Shocks in	Shocks in	Shocks in	Shocks in	Shocks in
VDs across months ↓ DHOMSHARE	Δ HOMSHARE	Δ IGAE	Δ VEHICLES	VDs across weeks ↓ DTCR	Δ TCR	Δ IGAE
1	100 (0.00)	0 (0.00)	0 (0.00)	1	100 (0.00)	0 (0.00)
12	92.94 (3.49)	4.89 (2.81)	2.17 (2.06)	12	94.21 (3.28)	1.72 (1.76)
DIGAE				DIGAE		
1	0.34 (0.92)	99.66 (0.92)	0 (0.00)	1	0.07 (0.61)	99.93 (0.61)
12	12.32 (4.49)	82.56 (4.97)	5.11 (3.02)	12	5.09 (3.27)	90.12 (4.20)
DVEHICLES				DVEHICLES		
1	0.00 (0.54)	2.56 (2.02)	97.44 (2.09)	1	1.75 (1.61)	4.11 (2.40)
12	4.93 (3.30)	6.54 (3.21)	88.53 (4.31)	12	6.66 (3.26)	8.72 (3.65)
LM tests (13 and 14 lags), SVAR with k = 13 lags	8.59	11.44		LM tests (14 and 15 lags), SVAR with k = 14 lags	5.36	7.48
[p-value]	[0.48]	[0.25]		[p-value]	[0.80]	[0.59]

Notes: After impulse responses are generated with 5,000 repetitions with structural lower triangular decomposition from DHOMSHARE (or DTCR) to DIGAE and to DVEHICLES last, variance decompositions are generated with Cholesky orderings with 5,000 repetitions. LM tests are for residual autocorrelation tests for number of lags as listed. Null hypothesis is that there is no serial correlation. Rejections of the null hypothesis at 5% level or lower appear in bold. Rejections of the null hypothesis at 5% level or lower appear in bold.

Table 5 Variance Decompositions of (1) of Pedestrians Border Crossings

Innovations	Innovations		Innovations →		Innovations	
	Shocks in	Δ HOMSHARE	Shocks in	Δ IGAE	Shocks in	Δ PEDESTRIANS
VDs across months ↓						
DHOMSHARE						
1	100 (0.00)		0 (0.00)		0 (0.00)	0 (0.00)
12	93.01 (3.63)		2.07 (2.18)		2.36 (1.98)	5.88 (2.93)
DIGAE						
1	0.12 (0.69)		0 (0.00)		99.88 (0.66)	0 (0.00)
12	9.64 (4.07)		4.54 (2.81)		88.19 (4.54)	6.24 (3.36)
DPEDESTRIANS						
1	2.35 (1.92)		97.58 (2.00)		0.02 (0.55)	99.70 (0.99)
12	5.23 (3.13)		88.11 (4.17)		5.68 (3.25)	87.83 (4.27)
LM tests (14, 15 lags), SVAR k = 14 lags	14.80		6.50		11.25	4.47
[p-value]	[0.10]		[0.69]		[0.26]	[0.88]

Notes: After impulse responses are generated with 5,000 repetitions with structural lower triangular decomposition from DHOMSHARE (or DTCR) to DIGAE and to DPEDESTRIANS last, variance decompositions are generated with Cholesky orderings with 5,000 repetitions. LM tests are for residual autocorrelation tests for number of lags as listed. Null hypothesis is that there is no serial correlation. Rejections of the null hypothesis at 5% level or lower appear in bold.

in the baseline model with dummy) and to shock 2 (IGAE) becomes + 0.004 (compared to 0.005 in the baseline model with dummy).

Concluding remarks

This paper adopts an interdisciplinary approach to border crossings. To explain the flows of personal vehicles and pedestrians from Mexico to the U.S., we introduce the border homicide share—containing the intensity of crime located in the border zone between Mexico and the U.S.—jointly with the Mexican industrial production index and the real exchange rate. The literature on drug cartels covers their regional operations and socio-economic outcomes. Dell (2015) characterizes via a network model of routes how cartels operate in Mexico to transport drugs to the border and beyond. Sobrino (2020) writes that the number of major DTOs (or cartels) in Mexico increased from four to nine over the last two decades and that this was accompanied by an increase in drug trade related violence and homicide rates. Our sample runs from 1997 to 2019 at a monthly frequency and includes the sudden increase in the homicide border share to peak in 2010 and then decreases and stabilization. Luhnnow and De Córdoba (2020) cover recent developments in the press. Past Mexican federal administrations (2006–12 and 2012–18) conducted campaigns against drug trade with ongoing repercussions, such as the recent indictments of former officials by U.S. authorities.

We compare this model with homicides to the economic model of the small open economy with monthly fluctuations in the real exchange rate. In Political Science and Economics, it is common to blend socio-economic forces. Enders et al. (2006) verify the effects of 9/11 on U.S. FDI and Seabra et al. (2020) investigate the connection between terrorism and tourist arrivals in Portugal with unrestricted VARs. We explore the two SVARs with minimum identifying assumptions and focus on the dynamic responses with restrictions imposed directly on the IRFs, recently reviewed by Lütkepohl et al. (2018). We find for the multidisciplinary model that personal vehicles respond negatively to innovations in homicide share: -0.004 in response to a positive structural shock to the homicide share, which remains negative and significant for months. Pedestrians respond on impact (-0.015) and in the second and third months, as well (-0.010 and -0.007). We thus identify a prolonged response of crossings by personal vehicles to border homicide share, in contrast to an immediate and larger response for pedestrians. Responses of vehicle crossings to shocks in economic activity are positive and significant in vehicles and more neutral in pedestrians.

The implications of observing a negative impact of crime on shocks is relevant to policymakers. One the one hand, for Mexican local authorities, the disruptions caused to pedestrian and vehicle crossings should be a matter of concern to society, especially in the case of legal workers whose main source of income in a job in the U.S. In the case of U.S. authorities, this finding is also relevant provided that legal crossings of Mexican citizens for work, shopping or leisure activity have a positive impact on economic activity, especially in communities along the U.S.-Mexican border. The presence of crime is thus detrimental for the economic activity and exchange between the two neighboring economies.

This dataset used in this paper ends in December 2019, which does not include the coronavirus period. We will update the dataset for 2020 for future work, which may address the disruptions to cross-border traffic caused by the coronavirus pandemic of 2020. Extensions to other methodologies able to handle a mix of stationary and non-stationary series (series in levels, without transformations) are welcome and left for future research.

References

- Anderson, W. P., Maoh, H. F., & Burke, C. M. (2014). Passenger car flows across the Canada–US border: The effect of 9/11. *Transport Policy*, 35, 50–56.
- Avetisyan, M., Heatwole, N., Rose, A., & Roberts, B. (2015). Competitiveness and macroeconomic impacts of reduced wait times at U.S. land freight border crossings. *Transportation Research Part A*, 78, 84–101.
- Baggs, J., Fung, L., & Lapham, B. (2018). Exchange rates, cross-border travel, and retailers: Theory and empirics. *Journal of International Economics*, 115, 59–79.
- Bel, G., & Holst, M. (2019). Assessing the effects of the Mexican drug war on economic growth: An empirical analysis. *Southern Economic Journal*, 85(1), 276–303.
- Brown, W. M. (2015). How much thicker is the Canada–US border? The cost of crossing the border by truck in the pre- and post-9/11 eras. *Research in Transportation Business & Management*, 16, 50–66.
- Bun, M. J. G., Kelaher, R., Sarafidis, V., & Weatherburn, D. (2020). Crime, deterrence and punishment revisited. *Empirical Economics*, 59, 2303–2333.
- Bureau of Transportation Statistics (2020). Border Crossing/Entry Data [Data file]. Retrieved on November 6, 2020 from <http://www.trade.gov/visitor-arrivals-program-i-94-data>
- Burns, M. (2019). Containerized cargo security at the US–Mexico border: How supply chain vulnerabilities impact processing times at land ports of entry. *Journal of Transportation Security*, 12(1–2), 57–71.
- Cabral, R., Mollick, A. V., & Saucedo, E. (2019a). Northbound border crossings from Mexico to the U.S. and the peso/dollar exchange rate. *Research in Transportation Business & Management*, 33, 1004–1023.
- Cabral, R., Mollick, A. V., & Saucedo, E. (2019b). Foreign Direct Investment in Mexico, Crime, and Economic Forces. *Contemporary Economic Policy*, 37(1), 68–85.
- Cabral, R., Mollick, A. V., & Saucedo, E. (2016). Violence in Mexico and its Effects on Labor Productivity. *Annals of Regional Science*, 56(2), 317–339.
- Chandra, A., Head, K., & Tappata, M. (2014). The Economics of cross-border travel. *Review of Economic Studies*, 96, 648–661.
- Chen, Z., Devereux, M. B., & Lapham, B. (2017). The Canadian Border and the US Dollar: The impact of exchange rate changes on US retailers. *Canadian Journal of Economics*, 50, 1525–1555.
- Dell, M. (2015). Trafficking Networks and the Mexican Drug War. *American Economic Review*, 105(6), 1738–1779.
- Di Matteo, L., & Di Matteo, R. (1993). The determinants of expenditures by Canadian visitors to the United States. *Journal of Travel Research*, 31(4), 34–42.
- Di Matteo, L., & Di Matteo, R. (1996). An analysis of Canadian cross-border travel. *Annals of Tourism Research*, 23, 103–122.
- Enders, W., Sachsida, A., & Sandler, T. (2006). The impact of transnational terrorism in tourism on U.S. foreign direct investment. *Political Research Quarterly*, 59(4), 517–531.
- Fullerton, T. M., & Walke, A. G. (2019). Cross-border shopping and employment patterns in the southwestern United States. *Journal of International Commerce, Economics and Policy*, 10(3), 1950015–1950015–19.
- Fullerton, T. M., & Walke, A. G. (2014). Homicides, exchange rates, and northern border retail activity in Mexico. *The Annals of Regional Science*, 53, 631–647.
- Garrido, R. A. (2000). Spatial interaction between the truck flows through the Mexico–Texas border. *Transportation Research Part a: Policy and Practice*, 34(1), 23–33.

- Gibbons, J. D., & Fish, M. (1987). Market sensitivity of US and Mexican border travel. *Journal of Travel Research*, 26(1), 2–6.
- Güntner, J. H. F., & Linsbauer, K. (2018). The effects of oil supply and demand shocks on U.S. consumer sentiment. *Journal of Money, Credit and Banking*, 50(7), 1617–1644.
- Hamilton, J., & Herrera, A. M. (2004). Comment: Oil shocks and aggregate macroeconomic behavior: The role of monetary policy. *Journal of Money, Credit and Banking*, 36, 256–286.
- Kilian, L. (2009). Not All Oil Price Shocks are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market. *American Economic Review*, 99(3), 1053–1069.
- Luhnöw, D., & De Córdoba, J. (2020). Top Mexican general indicted in drug trade. *The Wall Street Journal*, October 17, 2020.
- Lütkepohl, H., Staszewska-Bystrova, A., & Winker, P. (2018). Estimation of structural impulse responses: Short-run versus long-run identifying restrictions. *ASTA Advances in Statistical Analysis*, 102, 229–244.
- Maoh, H., Khan, S., & Anderson, W. (2016). Truck-movement across the Canada-US border: The effects of 9/11 and other factors. *Journal of Transport Geography*, 53, 12–21.
- Maoh, H., Gingerich, K., Husein, R., & Anderson, W. (2018). Examining the variability of crossing times for Canadian trucks at the three major Canada-U.S. border crossings. *The Professional Geographer*, 70, 350–362.
- McKercher, B., Chan, A., & Lam, C. (2008). The impact of distance on international tourist movements. *Journal of Travel Research*, 47(2), 208–224.
- Mehmood, S., Ahmad, Z., & Khan, A. A. (2016). Dynamic relationships between tourist arrivals, immigrants, and crimes in the United States. *Tourism Management*, 54, 383–392.
- Michaelsen, M. M., & Salardi, P. (2020). Violence, psychological stress and educational performance during the “war on drugs” in Mexico. *Journal of Development Economics*, 143, 102387.
- Murphy, T. E., & Rossi, M. A. (2020). Following the poppy trail: Origins and consequences of Mexican drug cartels. *Journal of Development Economics*, 143, 102433.
- Orraca-Romano, P., & Vargas-Valle, E. (2020). Drug-related violence and the decline in the number of Mexican cross-border workers. *Review of Development Economics*, 24, 485–502.
- Ritchie, J. B., Amaya Molinar, C. M., & Frechtling, D. C. (2010). Impacts of the world recession and economic crisis on tourism: North America. *Journal of Travel Research*, 49(1), 5–15.
- Rubio-Ramírez, J. F., Waggoner, D., & Zha, T. (2010). Structural vector autoregressions: Theory of identification and algorithms for inference. *The Review of Economic Studies*, 77, 665–696.
- Seabra, C., Reis, P., & Abrantes, J. L. (2020). The influence of terrorism in tourism arrivals: A longitudinal approach in a Mediterranean country. *Annals of Tourism Research*, 80, 102811.
- Simpson, P. M., & Siguaw, J. A. (2008). Destination word of mouth: The role of traveler type, residents, and identity salience. *Journal of Travel Research*, 47(2), 167–182.
- Simpson, P., Cruz-Milán, O., & Gressel, J. (2014). Perceived crime and violence: Effects on winter migrants. *Journal of Travel Research*, 53(5), 597–609.
- Skoll, G. R. (2011). Travel insecurity in North America: The Mexico-US border. *International Journal of Safety and Security in Tourism/hospitality*, 1(1), 45–63.
- Sobrinho, F. (2020). Mexican cartel wars: Fighting for the US opioid market. URL: <http://www.fersobrinho.com/files/DraftPaper.pdf>. This version: May 21, 2020
- Sullivan, P., Bonn, M. A., Bhardwaj, V., & DuPont, A. (2012). Mexican national cross-border shopping: Exploration of retail tourism. *Journal of Retailing and Consumer Services*, 19(6), 596–604.
- U.S. National Tourism and Travel Office (2020). I-94 arrivals program [Data file]. Retrieved on November 6, 2020 from <http://www.trade.gov/visitor-arrivals-program-i-94-data>
- Utar, H. (2018). *Firms and labor in times of violence: Evidence from the Mexican drug war*. CESifo Working Paper 7345.
- Woosnam, K. M., Shafer, C. S., Scott, D., & Timothy, D. J. (2015). Tourists’ perceived safety through emotional solidarity with residents in two Mexico-United States border regions. *Tourism Management*, 46, 263–273.