Household Responses to Escalating Violence in Mexico

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Despite catastrophic fallout from the Mexican drug war, headlines fail to capture the full cost to civilians. In this paper, we show that households adjusted both their consumption habits and altered their behavior in response to increased homicide rates in their municipality. We demonstrate that higher murder rates are associated with households reducing expenditure on visible commodities and with individuals avoiding carrying valuables and changing transportation routes. The spending changes occurred mainly for middle- and upper-income households, while the behavioral adjustments happened mainly in households that were poorer or headed by a female. Assuming that household behavior was in equilibrium before the escalation in violence, these adjustments represent a non-obvious, but significant, welfare loss which should be considered in any account of the costs and benefits of the drug war.

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Mexico's drug cartels have a long and storied history, owing largely to their proximity and access to the lucrative United States market. According to Melissa Dell, approximately "68 percent of Mexico's 2,456 municipalities were known to have a major drug trafficking organization or local drug gang operating within their limits in early 2008" (2011, p. 1744). Despite the scale of the cartels, violent crime in Mexico began declining in the 1990s and continued to do so until 2006 when President Felipe Calderón declared war on drug traffickers and engaged the military to combat them. By 2018, annual murders in Mexico had surpassed 35,000 per year, a rate roughly triple that prevailing in the early 2000s.[1]

Economic research on the effects of the escalation in violence have focused primarily on output, growth, risk aversion, human capital, and migration.[2] We argue that these fail to capture the full effects of the increased violence. We study how violence has affected the way in which ordinary individuals live their lives. In places where violence is pervasive, citizens may change their habits and their spending patterns. Those afraid of being targeted may no longer frequent restaurants and bars, they may stop wearing jewelry and refrain from purchasing fancy cars, or they may change the routes they take to get to work.[3]

Using household survey data from the Mexican Family Life Survey (MxFLS) spanning 2002 to 2012, we test whether there is a relationship between increased violence, as measured by homicide rates, and changes in visible consumption and behavior over time.[4] Our results show that as violence rises within a municipality, households spend less on highly visible goods. The same is not true for less-visible expenditures. The impact of homicides on consumption patterns,

[1] During the presidency of Felipe Calderón (2006 to 2012), there were more than 20,000 homicides per year (Calderón et al. 2019). The situation deteriorated further under Enrique Peña Nieto's presidency (2012-2018) as homicides averaged almost 30,000 per year.
[2] Gutiérrez-Romero & Oviedo (2017), Brown et al. (2019), Velásquez (2019), and Brown & Velásquez (2017).
[3] For more on conspicuous consumption and violence, see Mejia and Restrepo (2013) and Hicks & Hicks (2014).
[4] There are several papers that share the same empirical strategy as us but investigate different questions. See, for example, Velásquez (2019), Brown & Velásquez (2017), and Brown et al. (2019).

however, is heterogeneous. It is strongest for households in middle- and upper-income brackets as well as for households headed by males. In terms of behavior, individuals exposed to escalating violence report changing their transportation routes and avoiding carrying valuables, especially among female-headed and low-income households. In sum, our findings demonstrate that the increased violence in Mexico has had significant indirect utility costs as households changed their consumption patterns and daily behavior in response to life in a more dangerous environment.

2. Methodology and Data

The general form of our regressions for visible expenditure is the following:

$$\ln(Vis)_{i,j,t} = \beta_1 \ln(CR)_{j,t} + \beta_2 \ln(TotExp)_{i,j,t} + \beta_3 X_{i,j,t} + \beta_4 \mathrm{Z}_{i,j,t} + \omega_j + \varphi_t + \varepsilon_{i,j,t} \quad (1)$$

Where $\ln(Vis)_{i,j,t}$ is the log of visible consumption expenditures in household i, residing in municipality j, in survey year t. Following previous literature, we classify expenditures on commodities such as tobacco, personal care, entertainment, gambling, clothing, vehicles, and vehicle services as visible consumption.[5] When we study whether increases in the homicide rate lead citizens to significantly change their day-to-day behavior, we first estimate equation (1) for expenditure patterns and then we also run a variation of equation (1) with a linear probability model and new dependent variables we call $Behavior_{i,j,t}$. For the two behavior variables that we consider in our analysis, we use two questions from the MxFLS survey: (1) As a security measure, have you changed routes to reach the places you frequently go to?, and (2) How often do you carry valuables? Answers to the first question are Yes/No and are coded accordingly

[5] See Hicks and Hicks (2014), Charles et al. (2009) and Heffetz (2011). Panel A in Appendix Table A1 provides the summary statistics of visible consumption and its components, while Panel B provides the summary statistics of the variables that capture behavioral change in relation to routes taken and carrying valuables.

(equal to 1 if the respondent answers Yes, and 0 otherwise). Answers to the second question include very frequently, frequently, a little frequently, and not frequently. We create dummy variables from these responses where the variable is equal to 1 if the respondent answered very frequently or frequently, and 0 otherwise.

$\ln(CR)_{j,t}$ is the natural logarithm of the municipality homicide rate at the time of survey.[6] Homicides are more likely to be accurately recorded than other crimes because the presence of a corpse makes underreporting more difficult.[7] $TotExp$ controls for total expenditures in the household. $X_{i,j,t}$ is a vector of time variant household head characteristics such as age, gender, marital status, and educational attainment. $Z_{i,j,t}$ is a vector of household-level time variant demographics, including household size, number of earners, women, and children in the household. ω_j is a set of municipality fixed effects, while $\varphi_t$are survey year fixed effects.[8]

Our household and individual level variables come from the MxFLS.[9] The first wave of the survey, conducted in 2002, interviewed 35,000 individuals from over 8,000 households in 150 different municipalities around the country. One of the strongest features of this survey for our analysis is the fact that the second and third waves (in 2005-6 and 2009-12) successfully re-interviewed around 90 percent of the original households. The first two waves took place before the homicide rates began to increase precipitously, while the third wave surveyed households at a time period during which drug-related violence had seriously escalated.

[6] For zero values, we use a truncation method (we take the natural logarithm of half the minimum value which is equal to 1 in the sample).
[7] Yearly homicide data is derived from INEGI (Instituto Nacional de Estadística y Geografía). Summary statistics for homicide rates are in Appendix Table A2.
[8] The advantage of using year and municipality fixed effects is that there are many potential sources of endogeneity in the analysis, including time-invariant municipality level characteristics and trends common to all of Mexico. These will be absorbed by the fixed effects. Thus, the results are using variation in the level of violence and expenditure *within* municipalities *over time*.
[9] Appendix Table A2 shows summary statistics for our various control variables, including age, gender, marital status, and educational attainment of the head of the household, as well as the number of household members, females, income earners, and children.

Our estimations include year and municipality fixed effects to remove trends and to capture regional time-invariant characteristics. We use a pooled sample spanning all three waves of the MxFLS, standard errors are clustered at the municipality level, and the results are survey-weighted. In our analysis, in addition to evaluating the average relationship between behavioral responses and violence, we are interested in determining if the effect is heterogenous. We estimate our model for subsamples that consider the gender of the household head and income levels (low, middle, and high-income groups).[10]

3. Results

Panel A of Table 1 presents results with visible consumption as the dependent variable. In Column 1, the coefficient on the homicide rate is negative and significant, indicating that households in municipalities where violence increased over the period spent less on visible consumption as a response.[11] Our results show that a 10% increase in the homicide rate in a municipality is associated with a decline in visible consumption of around 0.81%. To better understand the magnitude, it is important to note that that the homicide rate over the period is actually quite volatile. The mean of the variable is 14.52 homicides per 100,000 people, and the standard deviation is 18.72. This implies that a one standard deviation increase in crime is equal to a 130% increase in the crime rate, which is associated with an economically meaningful decline in visible expenditures of around 10.5%. For robustness, we estimate Equation 1 using the log of non-visible consumption expenditures as the dependent variable. If the increases in crime are simply depressing economic activity, then non-visible expenditure may also decline

[10] We create three sub-samples based on income: households reporting no income, reporting greater than no income but less than the top quartile, and the top 25% of income-earning households.

[11] While households may respond to increased violence by migrating out of the affected area, Velásquez (2019) shows that migration rates are not especially high. If those who migrate are more sensitive to violence, our results understate the effect that violence has on visible consumption.

when crime rates increase. We find that as homicide rates increase, non-visible expenditure increases, suggesting that households are reallocating away from visible expenditures and toward non-visible ones.

Columns 2 and 3 of Panel A present the results when we divide the sample by gender of the household head. The effect of violence on visible consumption is slightly stronger in male-headed households. Column 4, 5, and 6 use sub-samples based on the level of household income. We find the effect of changes in the homicide rate on visible consumption to increase with income level. The poorest group displays an economically small and statistically insignificant coefficient. In the middle-income group, the regression produces an elasticity of around -0.10, which is significant at the 0.05 level. Households in the top quartile of reported income have an elasticity of around -0.12, which is significant at the 0.01 level. The absolute value of the elasticity for the highest income households is about 50% larger than those in the full sample, where the analysis effectively constrains the effect to be constant across income groups.

Panels B and C present our results of the effect of violence on whether the household head changed transportation routes for safety and how often he or she carried valuables. The results in Panel B imply that a one standard deviation increase in the homicide rate is associated with a 1.6 percentage point increase in the likelihood that an individual changed their route, driven largely by a 4.56 percentage point increase among female household heads. Unlike the consumption results, where middle- and upper-income groups significantly changed their visible consumption expenditures, here the poorest households responded to increasing homicide rates by changing their transportation routes. The results in Table 1, Panel C show that female household heads and low-income household heads also appear less likely to carry valuables.[12]

[12] This is consistent with the findings of Di Tella et al. (2010), who show that Argentines wear less jewelry during times of increased violence.

4. Conclusion

The war on drugs greatly increased violent crime in Mexico. In this paper, we have explored the effect of violent crime on how Mexican households live their lives. We find that beyond any aggregate effects on GDP or violence-induced migration, households reduce visible consumption (but not non-visible consumption) in response to increased violence.

We find a significant average effect but also important heterogeneity. In the face of rising homicide rates, middle income and richer households reduce visible consumption more than lower-income groups. Increased violence has also caused households that are poorer or headed by females to change transportation routes for safety and to carry less valuables. Thus, from our analysis it is evident that the costs of crime are borne more heavily by certain groups. While the greatest costs are the lost and ruined lives from the drug war inspired violence, this work suggests that there are also significant indirect utility costs for the survivors as they change their consumption patterns and behavior to respond to more dangerous environments.

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Table 1: The Heterogenous Effects of Violence across Mexican Households

Sample:	Full	Male Headed	Female Headed	Low Income	Middle Income	High Income
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A - Dependent Variable: Ln (Visible Consumption Expenditure)						
Ln(homicide rate)	-0.081**	-0.090**	-0.067	-0.023	-0.097**	-0.122***
	(0.038)	(0.042)	(0.056)	(0.078)	(0.048)	(0.044)
No. of obs.	23,395	17,908	5,487	5,886	11,602	5,907
Panel B - Dependent Variable: "Have you changed routes for safety?" (1 = Yes)						
Ln(homicide rate)	0.012**	0.006	0.035***	0.033***	0.007	-0.010
	(0.006)	(0.007)	(0.012)	(0.010)	(0.010)	(0.022)
No. of obs.	23,259	17,819	5,440	5,952	11,645	5,903
Panel C - Dependent Variable: "How often do you carry valuables?" (1 = Frequently or Some)						
Ln(homicide rate)	-0.009*	-0.004	-0.026***	-0.021**	-0.003	-0.006
	(0.005)	(0.006)	(0.010)	(0.009)	(0.007)	(0.012)
No. of obs.	23,259	17,819	5,440	5,952	11,645	5,903

Notes: Coefficients and standard errors for the homicide rate variable (in natural logs, where we use a truncation method for values equal to zero) when we estimate our model for the full sample and subsamples. Estimations include household head and household level control variables and year and municipality fixed effects. Pooled sample spanning all three waves of the MxFLS. Regressions include a constant. Standard errors are clustered at the municipality level and are reported in parenthesis. Results are survey weighted. *** p<0.01, ** p<0.05, * p<0.1 Source: Authors' calculations using the MxFLS I, II, and III and homicide rates constructed by authors using INEGI data.

Online Appendix

Table A1: Summary statistics of dependent variables

	(1) **Full Sample**	(2) **Wave I**	(3) **Wave II**	(4) **Wave III**
Panel A: Disaggregated visible consumption				
Visible Expenditure	9,693	9,205	9,012	10,793
Tobacco	444	362	367	593
Personal Care	3,537	2,933	3,301	4,316
Entertainment	520	546	536	482
Gambling	48	43	52	48
Clothing	2,854	2,454	2,777	3,296
Men	931	794	928	1,062
Women	1,066	924	1,037	1,224
Children	857	736	812	1,011
Vehicles	1,373	1,821	1,297	1,034
Vehicle Services	921	1,055	685	1,025
Panel B: Behavioral change related to routes taken and carrying valuables				
"Have you changed routes for safety?"	0.102	0.111	0.082	0.112
	(0.30)	(0.31)	(0.27)	(0.32)
"How often do you carry valuables?"	0.052	0.047	0.057	0.52
	(0.22)	(0.21)	(0.23)	(0.22)

Notes: Column (1) reports estimates for the pooled sample covering all three waves of the MxFLS, while columns 2, 3, and 4 for the different waves. Standard deviations are reported in parenthesis where informative. Estimates are survey weighted. We follow the literature in deciding which categories qualify as conspicuous consumption (Charles et al. 2009; Heffetz, 2011). Visible expenditures make up about 16% of total expenditures in our sample, although this fraction is larger among wealthy households. Source: Authors' calculations using the MxFLS.

Table A2: Summary statistics of homicide rates and control variables

	(1)	(2)	(3)	(4)
Panel A: Municipality Crime	**Full Sample**	**Wave I**	**Wave II**	**Wave III**
Homicides (per 100,000 population)	14.52	10.78	11.52	18.30
	(18.72)	(10.83)	(15.51)	(22.62)
Municipality Min	0.42	0.42	0.48	0.94
Municipality Max	188.08	76.70	137.17	188.08
Panel B: Household Head Characteristics				
Age	47.66	46.41	48.04	48.45
	(15.95)	(15.52)	(15.88)	(16.35)
Female	0.24	0.21	0.22	0.28
Married	0.63	0.65	0.64	0.61
Student	0.01	0.02	0.01	0.01
Education Level Indicator				
Less than Elementary	14.00	14.44	14.88	12.80
Elementary	45.57	47.45	47.24	42.34
Secondary	22.03	19.77	20.71	25.30
High School or Normal	10.29	9.73	9.32	11.67
College/univ/postgrad	8.11	8.61	7.85	7.89
Panel C: Household Characteristics				
Household Size	4.41	4.17	4.56	4.48
	(2.25)	(1.01)	(1.41)	(1.51)
Number of Earners	1.19	1.27	1.26	1.03
	(2.04)	(1.02)	(1.32)	(1.53)
Number of Women	2.29	2.18	2.38	2.31
	(2.31)	(1.00)	(1.46)	(1.55)
Number of Children	1.51	1.55	1.58	1.41
	(2.34)	(0.98)	(1.43)	(1.45)
Total Expenditure	60,127	53,607	56,339	69,741
	(52,854)	(49,587)	(51,146)	(55,913)

Notes: Columns (1) and (2) report estimates for the pooled sample spanning the three waves of the MxFLS. Standard deviations are reported in parenthesis where informative. Estimates are survey weighted. The full sample has 24,257 observations, while waves I, II, and III have samples of 7,879, 7,742, and 8,636, respectively.

Panel A Notes: Unweighted municipality averages of in-sample municipalities only. Sample sizes by wave are 137, 180, and 278, respectively. We constructed homicides rates using population data at the municipal level, also provided by INEGI every 5 years, and we use interpolation to fill in the missing years.

Source: Authors' calculations using data from INEGI (2018a,b) for Panel A and the MxFLS for Panels B and C.

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