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Mental Health and Labour Supply: Evidence from Mexico's Ongoing Violent Conflicts

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Abstract: In Mexico, conflicts between drug-trafficking organisations result in a high number of deaths and immense suffering among both victims and non-victims every year. Little scientific research exists which identifies and quantifies the monetary and non- monetary consequences of ongoing violent conflicts on individuals. Using the Mexican Family Life Survey for 2002 and 2005, the causal effect of mental health (symptoms of depression / anxiety) on the extensive and intensive margin of labour supply for working- aged men and women is estimated. Measures of the ongoing drug-related violent conflicts both at the macro level using intentional homicide rates by region, and at the micro level indicated by the presence of armed groups in the neighbourhood, serve as instruments for mental health. The results show a significant adverse impact of the conflicts on anxiety for men and women. Based on IV-Tobit model results, a worse mental health state decreases individual labour supply strongly and significantly for men. The findings demonstrate that Mexico's population not only suffers from the violent conflicts between drug-trafficking organisations by anxiety or even depression but also indirectly from less household income through less work which in turn has consequences for Mexico's social development and economic growth.

Key words: Mental health; Labour supply; Violent conflict; Mexico

JEL Classifications: J22; I19; O12; D74

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1 Introduction

In the last two decades, the drug-related conflicts in Mexico where drug trafficking organisations (DTOs) fight over trafficking routes into the United States has increased dramatically. A high number of crimes, such as corruption, assaults, kidnappings, torture, rapes and homicides, are being committed regularly. The extent to which the lack of national security harms Mexico's social and economic development, and consequences of wars and conflicts on individuals in general, have received little attention in scientific research (Blattman and Miguel, 2010). Only a few studies explicitly focus on the effects of violent conflict on labour market outcomes, such as Abadie and Gardeazabal (2003); Calderón and Ibáñez (2009); Menon and van der Meulen Rodgers (2011); Miaari and Sauer (2011) and Bozzoli et al. (2010). For a better understanding of the monetary and non-monetary consequences of violent conflict on civil society, in this study the impact of Mexico's drug-related conflicts on mental health measured by symptoms of depression / anxiety (SDA) – a main determinant of mental health – is estimated. Further, it is investigated as to which extent deteriorated mental health affects the extensive and intensive margin of individual labour supply. While a reduction in individual labour supply has negative consequences on income, deterioration in mental health can also induce substantial non-monetary costs for example on the dependent children of the anxious / depressed adult (e.g., Heckman, 2006; Petterson and Albers, 2001; Bratti and Mendola, 2011).

Within the Mexican population, anxiety / depression is a serious health issue. Belló et al. (2005) estimate that 4.5% of the population aged 18 to 65 are affected by depression and an even higher rate has experienced a period of depression of more than 12 months in life. The effect of mental illnesses such as depression, anxiety or psychological distress on labour market participation and labour supply has been investigated in many studies for different countries. The main body of this literature uses instrumental variable (IV) approaches to control for the reverse causality between mental health and labour supply. Recent innovative approaches are, e.g., Chatterji et al. (2007) who use early onset psychological disorders and religious activities as instruments in a sample of Latin American and Asian immigrants in the U.S., Ojeda et al. (2010) who use measures of social support and Frijters et al. (2010) who use the incidence of the death of a close friend in the Household, Income and Labour Dynamics in Australia survey. All studies find a large negative effect of bad mental health on labour market participation or labour supply. For developing countries and countries hit by armed conflicts, the literature is almost non-existent with one exception: Das et al. (2009) use mental health surveys from five developing and transition countries (Bosnia and Herzegovina, Indonesia, Mexico, India and Tonga) and study correlations between mental health, socio-economic status and labour market participation.

This study is based on data from the Mexican Family Life Survey (MxFLS, or ENNVIH in Spanish), a representative household survey, for the years 2002 and 2005 – years in which drug-related violence has been intense but not as severe as it became in 2008, when drug-related homicides have dramatically increased by approximately 600% from one year to another (Shirk, 2010). Overall, drug-related homicide rates have accumulated to 20,000 in the last decade (Shirk, 2010).

The MxFLS includes a battery of questions to determine a person's emotional well-being and a large number of other health, socio-economic and labour market variables. An individual's emotional well-being is measured via a 20-item questionnaire with four different answering possibilities. The latent variable from these 20 items is derived in this study using the partial-credit Rasch model, deduced from item response theory (IRT) (Masters, 1982). Similar to the studies cited above, an IV approach is employed. Exploiting regional variation in violence data to instrument mental health allows identifying the causal effect of violent conflicts on anxiety / depression among the Mexican population and to which extent economic outcomes in terms of labour supply are indirectly affected by violent conflicts. It has been documented in a large number of studies by practitioners, health researchers and social scientists that exposure to armed conflicts and violence has severe impacts on mental health (e.g., Kessler, 1997; Kendler et al., 1999; Latkin and Curry, 2003; Giacaman et al., 2007). According to the data used deterioration of mental health may simply imply sleeping problems but also capture severe anxiety and depression symptoms measured by the SDA questionnaire. The main assumption in the present study is that exposure to violent conflicts as they happened in Mexico during the first half of the 2000s does not directly affect individual labour supply but only via deterioration of mental health. This implies that no demand shocks exist which are correlated with conflict intensity. Several arguments on the validity and anecdotal evidence by CAMEXA (2010), Osorio (2011) and Ríos (2008) to support this assumption are provided. Due to potential corner solution problems in the dependent variables, Tobit and IV-Tobit models are estimated.

The empirical findings reveal that exposure to violent conflicts has large and significant effects on anxiety and suggest that Mexico's society suffers severely from the ongoing violent conflicts. Furthermore, men who suffer from SDA possess a lower probability to be working and worked both fewer weeks in the last year and fewer hours in the previous week. For women, no effects on labour supply are found. The causal effects found for men show that the conflicts indirectly affect labour income through reduced work which in turn may have long-term impacts on Mexico's social development and economic growth. The analysis helps to understand the monetary and non-monetary consequences of low to medium level intensity of violent conflicts in general and in Mexico in particular. To

the author's best knowledge, no study exists which identifies the causal effect of anxiety on labour supply in violent conflict settings. Furthermore, the analysis contributes to the literature on violence in Mexico which is small so far and only looks at the determinants of violence and violence intensity rather than the consequences.[1]

The outline of the study is as follows. The next section gives some background information on the drug-related conflicts in Mexico and summarises the literature on (1) the relationship between armed conflicts and mental health and (2) studies dealing with the impact of mental health on labour market participation and labour supply. Section 3 describes the methodological approach and the data. Subsequently, the results are being presented and discussed in Section 4, Section 5 provides checks of robustness and Section 6 concludes.

2 Background

Mexico's location has served as the transit for drug trafficking between Central America and the United States for decades. Drug trafficking has increased since the 1980 when Colombia's largest trafficking organisation co-operated with Mexican cartels to transport cocaine into the U.S. (Felbab-Brown, 2009). While Mexico's DTOs focused mainly on the demand for drugs in the U.S. during the 1980s and 1990s, domestic demand has also gained importance in recent years (Pacheco, 2009). As a result, the DTOs do not only fight over trafficking routes but have also started to fight over local domestic end-user markets in Mexico. Through the death or arrest of cartel leaders, fluctuations in size, number and power of DTOs occur. Violent conflicts exist between DTOs, within DTOs where hierarchical levels can be imposed through violence, and between DTOs and security forces. In a number of cases, former police and military employees established and/or rule DTOs. For example, the Guadalajara cartel, one that was most influential during the 1980s, was founded by a police officer (Mahadevan, 2011). This provides an indication for the influential role of corruption and bribery in Mexican institutions which also occurs among its political leaders (Shirk, 2010).

The competition between the DTOs over trafficking routes and markets has led to an increased number of fights and stronger violence. Among intentional homicide are kidnapping, assault, torture and battery common crimes which are being committed. In 2002 and 2005, the years of investigation of this study, homicide rates on the state level ranked between 1 and 40 per 100,000 inhabitants.[2] Figures A1 and A2 show the incidence

[1] One notable exception is Dell (2011) who looks at the effect of drug-related violence on formal and informal wages after 2008.

[2] Instituto Ciudadano de Estudios sobre la Inseguridad (ICESI), 2011, "Estadísticas oficiales", retrieved: May 3rd, 2011, from http://www.icesi.org.mx/estadisticas/estadisticas_oficiales.asp.

of drug-related homicides for the years 2002 and 2005 based on data from ICESI. The rates suggest that drug-related violence is not only a problem at the border to the U.S. but also in other parts of the country, where trafficking routes exist.

The effect that conflict settings, civil wars and other stressful life events have on mental disorders and illnesses has well been documented by psychologists, health researchers and social scientists. There is no doubt that mental health is impaired by such events.[3] For instance, Cornaglia and Leigh (2012) investigate the impact of crime on mental health of non-victims, arguing that the cost of crime on non-victims' mental well-being may be even higher than the cost induced for direct victims. Variation in local crime rates is used to estimate the impact of crime on mental well-being of the population in the certain localities. They find that violent crime and newspaper coverage of criminal incidents have a large impact on emotional well-being. For a civilian in Mexico, the fights between DTOs are likely to harm everyday life by causing anxiety and fear or even depression symptoms, not only because of reports in the newspapers but also because of increased presence of police and security forces on the streets.

De Jong et al. (2003) use epidemiological surveys to look at post-war mental disorders. They find that post-traumatic stress disorders and anxiety disorders are the most common health issues in their samples and state that post-conflict health programmes should focus on a variety of mental health problems. Murthy and Lakshminarayana (2006) give an overview of the effects of war on the mental health states of civil society in Southeast Asian countries and the Middle East. They summarise that women and children are affected most severely and that social and psychological support is associated with better mental health.

Using data from the German Socioeconomic Panel, Brück and Müller (2010) show that both crime and terror lead to worries among both victims and non-victims. Based on a survey of Palestinian adolescents ,Giacaman et al. (2007) investigate mental health states after collective and individual exposure, trauma and violence through the military. They find that collective exposure to conflict has a strong and similar effect as individual exposure on mental health.

The latter two studies show that not only direct victims of violence are affected by mental distress, but also that indirect or common exposure affects individual mental health. This justifies the use of drug-related homicides and the presence of armed groups in the neighbourhood as measures of exposure to violent conflicts in Mexico, rather than, for example, focusing on individuals who have directly been involved in a violent act or have lost a family member due to conflict. Apart from the fact that access to such data

[3]See Kessler (1997) for an overview on the literature.

is rare, the latter statistics cannot be used as instruments as they may directly affect individual labour supply through physical damage and lack in household income.

Instrumental variable approaches are commonly used in the context of mental health and labour supply due to the reverse causal relationship between the two phenomena, i.e. mental illness leads to lower labour supply; simultaneously, unemployment or working few hours or weeks affects mental well-being. One example is a study based on the Household, Income and Labour Dynamics in Australia survey in which the incidence of death of a close friend is used as an instrument for mental health to estimate the causal effect of mental health on labour market participation (Frijters et al., 2010). Other instruments that have been used are early onset psychological disorders and religious activities (Chatterji et al., 2007), measures of social support (Ojeda et al., 2010), and information on mental health history and mental health of the respondent's partner (Ettner et al., 1997). The studies commonly find negative effects of mental illness on labour market outcomes, with differences by socio-economic groups. So far, no study on this relationship exists which focuses on countries which have been or are currently affected by violent conflicts.

An important fact that has been highlighted in some studies is that diagnostic data is only seldom available (Ettner et al., 1997; Chatterji et al., 2007). In many surveys, mental health is self-assessed which may lead to a substantial attenuation bias in the estimated effect of mental health on labour market outcomes. The MxFLS also allows the use of diagnostic data, exhibiting a strong advantage to other household surveys.

The findings of this study reveal the impact of the violent conflicts in 2002 and 2005. It appears likely that the consequences of violent conflicts have become even more severe with the escalation in 2008, just little more than one year after the start of Felipe Calderón's presidency. In 2006, he declared 'war' against the drug cartels, and military troops entered the streets of civil society (Shirk, 2010). The 'drug war' accelerated in 2008, counting more than 6000 drug-related homicides in that year committed by cartel members, policemen, the military and other security personnel.[4]

3 Methodology and Data

3.1 Methodology

Reverse causality

[4]Shirk (2010) uses the number of killings reported in Mexican newspapers, which differ among each other and from government statistics. As it is difficult to judge if governmental statistics or newspaper counts are more reliable, this statistic is used here to give some intuition of how intensive the conflict has become.

The estimation of a causal effect of SDA on labour supply is hampered by the reverse causal relationship between these two variables. On the one hand, a depressed person may work less, i.e. have lower labour supply, because there are hours or days in which the person feels unable to leave the house and work. Even at lower levels of SDA, a person may work less because he or she changes routes to go to work to avoid walking or driving alone through insecure areas, or may not work in the evening hours because he or she is too anxious to walk in the dark. Labour migrants may not want to travel long distances anymore leading to lower labour supply and so on. On the other hand, having no job or not being able to work as much as preferred may lead to SDA (Clark and Oswald, 1994; Theodossiou, 1998). Hence, in a simple ordinary least squares (OLS) regression, a causal effect of mental health on labour supply cannot be identified and the OLS estimator is inconsistent. Instead, a partial correlation between the two variables is identified by the coefficient of the mental health variable. To identify a causal effect of symptoms of anxiety / depression, an Instrumental Variable (IV) approach is employed.

The main, structural equation of interest, the effect of SDA (mental health m) on the intensive margin of labour supply ($y, y > 0$), i.e. the number of weeks or hours worked, can be written as:

$$y_{it} = \alpha_1 + \beta m_{it} + \gamma_1 X_{it} + \epsilon_1, \tag{1}$$

where i is an index for the individual and t is a time index, X is a vector of controls and ϵ is the error term. In this model, m_{it} is an endogenous variable which is regressed on all variables X_{it} and the instrument(s) c in the first stage. The reduced-form model can be written as:

$$m_{it} = \alpha_2 + \gamma_2 X_{it} + \delta c_{it} + \epsilon_2. \tag{2}$$

Given that the variable c is a valid instrument, i.e. $E(\epsilon_1|c) = 0$ and m and c are partially correlated, the IV estimator is consistent and can be interpreted as a causal effect. In a following subchapter it is discussed in detail why the instruments used are valid conditionally on the exogenous regressors. The identified causal effect in the case of a binary instrument (*armed groups in the neighbourhood*) is a local average treatment effect (LATE), or average treatment effect for a subpopulation of compliers, i.e. those individuals whose mental health outcome deteriorates due to a change in the instrument (Angrist and Imbens, 1995). In the case of the continuous instrumental variable (*intentional homicide rates*), the identified effect is the causal marginal treatment effect (MTE) (Heckman and Vytlacil, 2007). Given that the endogenous regressor SDA is continuous, the effects are weighted by the compliers, where the weights are determined by how the compliers

are distributed over the range of the endogenous variable m. Hence, the estimated effects have to be interpreted within the scope of the particular subpopulation of compliers and cannot be interpreted as the average effect of the whole sample population. It has to be kept in mind that in the binary instrument *armed groups in the neighbourhood*, only 10% of the population are affected. To increase the number of compliers, the models are estimated including both instruments jointly. When using two instruments, the estimated effect is the weighted average of the causal effects for the two instrument specific compliant subpopulations (Imbens, 2010).

Instrumental Variable Probit (IV-Probit) models are estimated to identify the effect of SDA on the probability to be working, i.e. the extensive margin of labour supply. In the results tables, marginal effects are displayed. Since the data are an unbalanced panel, observations for each individual are not independent and thus standard errors are clustered on the individual level. In the linear models, standard errors are two-way clustered on both the individual and household level.[5] Standard errors are then also robust to arbitrary within-panel autocorrelation. As, for example, Moulton (1990) shows, standard errors are likely to be downward biased in models where aggregate variables are matched to individual level analyses, it would be preferable to cluster standard errors at the state level (homicide data is at the state level). However, too few clusters would be constructed using this approach such that the estimated covariance matrix of moment conditions is not of full rank. Hence, it has to be kept in mind that in the IV models, standard errors may be downward biased. In the IV-Tobit models, standard errors are bootstrapped, bypassing the problem of clusters.

It will be tested for overidentification based on Hansen's J statistic in the models where two instruments are used. Hansen's J statistic is reported rather than the Sargan-Hansen test because of clustered standard errors (e.g. Baum et al., 2007). Furthermore, tests for weak instruments are conducted. First, the Stock and Yogo (2005) test statistic is reported. Following this test, the instrument is weak if the minimum Eigenvalue statistic of the first stage exceeds the critical values.[6] It will be indicated in the result tables whether the Eigenvalue statistics is less than the Stock-Yogo 25% critical value test or not.

Finally, it has to be noted that estimating Fixed Effects-IV models may also be an adequate alternative approach. However, with the data at hand, a Fixed Effects model is not feasible for the following reasons: (1) Only two waves are available for the study

[5] To estimate the models in Stata the command *ivreg2* by Baum et al. (2002) is used. The multi-way clustered standard error procedure for non-nested samples is explained in Cameron et al. (2011).

[6] The minimum Eigenvalue statistic is identical to the Angrist-Pischke first-stage F (Angrist and Pischke, 2009) in the case of two instruments, and the Kleinbergen-Paap rk Walf-F in the case of one instrument.

in which only 50% of the interviewed individuals are part of both waves; (2) for the 50% of individuals little time-variation exists in the measure of SDA.

Corner solution

Using the IV approaches as explained above the causal effect of SDA on the intensive and extensive margin of labour supply is estimated separately without controlling for the effect of a change in the extensive margin due to a change in SDA when measuring the effect of a change in SDA on the intensive margin of labour supply. In fact, only 92% of men and 36% of women of the sample have positive values for weeks and hours worked and the remaining individuals do not earn income through work. For some individuals the optimal outcome of the dependent variable may be the corner solution $y = 0$. Not controlling for this corner solution may lead to potential bias in the estimated coefficients of the intensive margin of labour supply. This is likely to be the case in the coefficient on mental health because a depressed person may have lost his or her job due to SDA. Then, labour supply is not just lower than that of mentally healthy individuals but equals zero, while the independent variables are fully observed. To account for the corner solution in the dependent variable, a Type-I-Tobit model is applied. Furthermore, to account for reverse causality, an IV-Tobit model is estimated. Since interest is in the causal effect of mental health on labour supply for those individuals who have positive hours of work (the latent variable), marginal effects for the positive values, i.e. $E(y|x, y > 0)$, are presented in the regression tables. All models are estimated for men and women separately.

Validity of the Instruments

Two variables are used to instrument mental health. These variables measure the intensity of violent conflicts at macro and micro levels, respectively. The intuition of using the two variables related to violent conflicts is that due to the conflicts in Mexico, civil society may have developed a level of anxiety and / or depression symptoms which is higher in regions where conflicts are more intense.

The micro level indicator of violent conflict is the presence of armed groups in the neighbourhood. This information is taken from the household crime and victimisation questionnaire of the Mexican Family Life Survey which provides the individual level data for this study. This variable is a dummy variable taking the value one if an individual reports that armed groups are present in his or her neighbourhood and zero if they are not present. The macro level indicator is the number of intentional homicides per 100,000 inhabitants per state provided by ICESI.

To be valid instruments the presence of armed groups and intentional homicide rates must not directly affect labour supply but only via deterioration in mental health –

conditionally on the included covariates. It has been shown for other countries that regional violent conflicts are associated with the development of the regional economy and hence, job opportunities. Deininger (2003) provide an overview, and rare examples of studies on direct links between conflicts and labour supply are Miaari and Sauer (2011) and Mansour (2010). While a direct relationship is also likely to be the case after the escalation of conflict intensity in Mexico in 2008 (although no study exists so far), this is unlikely for the years 1998 to 2007 during which little time variation in intentional homicide rates existed and conflict intensity was relatively low.

As a proxy for labour demand, unemployment rates are displayed together with intentional homicide rates in Figure A4 for the years 1998 to 2010 for all fifteen states which are part of the Mexican Family Life Survey. It can be seen that before 2008, unemployment rates and intentional homicide rates do not follow the same pattern. Also, it can be seen that no shocks in conflict intensity have happened during this period. Rather, a steady intensity can be observed. At the same time, large fluctuations in unemployment rates can be observed. Anecdotal evidence for the independence between conflict intensity and labour demand is provided by CAMEXA (2010) who show that German direct investment in Mexico is not responsive to crime rates. Since no shocks in conflict intensity can be observed, it can be ruled out that labour demand shocks are directly linked to the relatively low conflict intensity during the investigated time span.

To ensure that intentional homicide rates and the presence of armed groups in the neighbourhood are also not indirectly correlated with local labour demand shocks, economic and social development indicators are included in the regressions. At the municipality level, human development indices (HDI) on health standards, educational levels and income levels are obtained from UNDP[7] for the years 2000 and 2005. Unfortunately, HDI data on municipality level are not available for 2002, hence the UNDP data for 2000 is matched to the 2002 wave of the MxFLS data[8] and the 2005 data is matched to the 2005 wave. Additionally, state level emigration rates,[9] GDP (at 2005 prices)[10] and registered and unregistered unemployment rates[11] are included. Table 1 shows that in-

[7]United Nations Development Programme (UNDP), "Índice de Desarrollo Humano Municipal en México 2000-2005", retrieved July 15th, 2011, from http://www.undp.org.mx/spip.php?article893.

[8]Although the data is from different years, matching the 2000 HDI data with MxFLS data from 2002 seems to be a better approach than not controlling for municipality characteristics at all.

[9]Emigration rates are gender-age-state-specific differences in population size between 1990 and 2000 corrected for mortality. The calculation is based on Census data for 1990 and 2000 retrieved from IPUMS (https://international.ipums.org/international/) and mortality data available from INEGI (http://sc.inegi.org.mx/sistemas/cobdem/creararbolfiltroservlet).

[10]Data retrieved from Sistema Estatal y Municipal de Bases de Datos (SIMBAD) from Instituto Nacional de Estadística, Geografía e Informática (INEGI) at http://sc.inegi.org.mx/sistemas/cobdem/creararbolfiltroservlet.

[11]INEGI "Encuesta Nacional de Ocupación y Empleo (ENOE)", retrieved May 5th, 2011 at http://www.inegi.org.mx/est/contenidos/espanol/sistemas/enoe/infoenoe/default.aspx?s=est&c=14042.

tentional homicide rates and the presence of armed groups are only marginally correlated with emigration rates, unemployment, GDP, or health, education and income indices. Moreover, studies by Osorio (2011) and Ríos (2008) on Mexican conflicts show, on the verge of their studies, that poverty / GDP is not linked to conflict intensity.

Including these aggregate measures in the regression ensures that intentional homicide rates are a measure of exposure to the conflict – not the regional labour market – and hence are likely to influence mental health by triggering anxiety or even depression symptoms. Finally, the only drawback of this measure is that it is prone to measurement error. Homicide rates in Mexico are unlikely to be exact, especially in those areas where the conflicts are very intense. Shirk (2010) provides a discussion of this problem. It is reasonable to assume that this measurement error is uncorrelated with the other regressors and does not cause any problems in the regressions.

Instead of using intentional homicide rates at the state level it would be desirable to include measures at a more disaggregated level to benefit from more variation and precision. However, counts of intentional homicides at a more disaggregated (municipality) level for the years 2002 and 2005 were only available for urban areas.[12] When merging this data with the MxFLS, more than two thirds of the observations would be lost, since only half of the Mexican states are covered by each data set and they only coincide partly. Hence, instead of municipality level statistics, the state level homicide rates are used. Using the number of direct victims, such as the number of lost household members due to conflicts, would not be a valid instrument as a direct relationship between being a member of such a household with a lost household member and the supply of labour is likely. Instead, being exposed to violent conflict but not being a direct victim is likely to be measured by a higher aggregation of intentional homicide rates (while controlling for direct victimisation). As mentioned earlier, solely the reading of newspaper articles about criminal incidents reduces people's mental health (Cornaglia and Leigh, 2012).

3.2 Individual-level Data

The data used is the Mexican Family Life Survey, a large household panel collected in 2002, 2005 and 2008. The first two waves, which are available at present, are exploited in this study. The MxFLS contains data on about 8,400 households, is representative on the national level and covers rural and urban households (Rubalcava and Teruel, 2006). A variety of topics is covered by the questionnaires, ranging from education, employment and crime to health status, and many more. After deleting observations with missing or implausible information, almost 25,000 person-year-observations remain for male and

[12] Centro de Investigación y Docencia Económicas (CIDE) "Geocrimen – Análisis Espacial y Series de Tiempo", http://geocrimen.cide.edu/.

Table 1: Correlation between Economic Development and Armed Conflict

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Homicides/100,000 inhabitants	1.000								
(2) Armed groups in neighbourhood	0.035	1.000							
	(0.000)								
(3) Emigration rate	0.084	-0.001	1.000						
	(0.000)	(0.906)							
(4) Unemployment rate, registred	-0.326	0.009	-0.191	1.000					
	(0.000)	(0.142)	(0.000)						
(5) Unemployment rate, unregistered	0.247	0.032	0.223	-0.078	1.000				
	(0.000)	(0.000)	(0.000)	(0.000)					
(6) Emigration rate	0.084	-0.001	1.000	-0.191	0.223	1.000			
	(0.000)	(0.906)	(1.000)	(0.000)	(0.000)				
(7) HDI health	-0.072	0.042	-0.045	0.152	0.042	-0.045	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
(8) HDI education	-0.134	0.050	-0.099	0.380	-0.061	-0.099	0.745	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
(9) HDI income	-0.164	0.051	-0.129	0.282	-0.022	-0.129	0.831	0.825	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	
(10) Deprived neighbourhood	0.015	0.062	0.067	0.035	0.109	0.067	0.102	0.133	0.122
	(0.016)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

female individuals aged 20 to 65. Excluded from the sample are individuals who retired, students, and those unable to work due to disabilities and prolonged sickness. Figure A3 indicates in which municipalities interviews have been conducted. Comparing Figures A1 and A2 reveals that interviews have taken place in regions of all levels of conflict intensity.

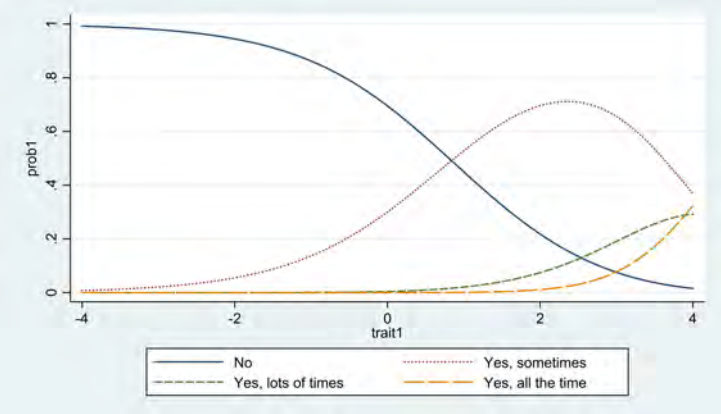
The individuals' mental health status can be interpreted from the responses to a mental health questionnaire which was adapted by researchers of the Mexican Institute of Psychiatry (Calderon, 1997) on the basis of the depression scale of the Center for Epidemiologic Studies (CES) (see Radloff, 1977).[13] Its purpose is the quantitative diagnosis of depression / anxiety symptoms using a battery of 20 questions, such as "In the last four weeks, have you had a hard time sleeping at night?" and "In the last 4 weeks, have you wished you would die?". Each question can be answered with four response categories indicating the intensity. Each answer is given points from 1 (no) to 4 (yes, always). The scale consists of the sum of the responses with equal weights, consequently ranging from 20 to 80 (Calderon, 1997). Figure 2 displays its highly right-skewed distribution. According to Calderon (1997), individuals can be classified into four categories: normal persons (89.6%), persons with a certain level of anxiety (8.5%), persons with an average depression (1.7%) and persons with severe depression (0.2%). The numbers do not necessarily coincide with estimates by, e.g., Belló et al. (2005) due to different diagnostic methods used. Based on these questions, an increase in the scale does not necessarily imply the diagnosis of anxiety or even depression. Rather, an increase can be due to, for instance, light sleeping problems or it can indicate whether someone felt sad or angry during the last four weeks. The fact that somebody is tired, angry or anxious is likely to influence his or her taste for work or ability to work.

A person's mental health state is actually not observable and is being tried to capture via the 20 items of the CES questionnaire. Item response theory offers statistical models to measure the latent variable. A partial-credit Rasch model is the appropriate model for measuring SDA based on the 20 items with 4 response categories. The mathematical background and rationale is explained in Masters (1982), it has previously been used in, e.g., Cole et al. (2004), Covic et al. (2007) and Ryan and Sinning (2009) and is implemented in Stata as explained in Zheng and Rabe-Hesketh (2007). Figure 1 displays the category probability curves. The resulting variable SDA (pcm) is standardised with mean zero and standard deviation 1. Its distribution is displayed in Figure 2 and exhibits a highly, but less than in the linear case, right-skewed shape.

The dependent variables are (a) *working* which is a dummy variable equal to 1 if

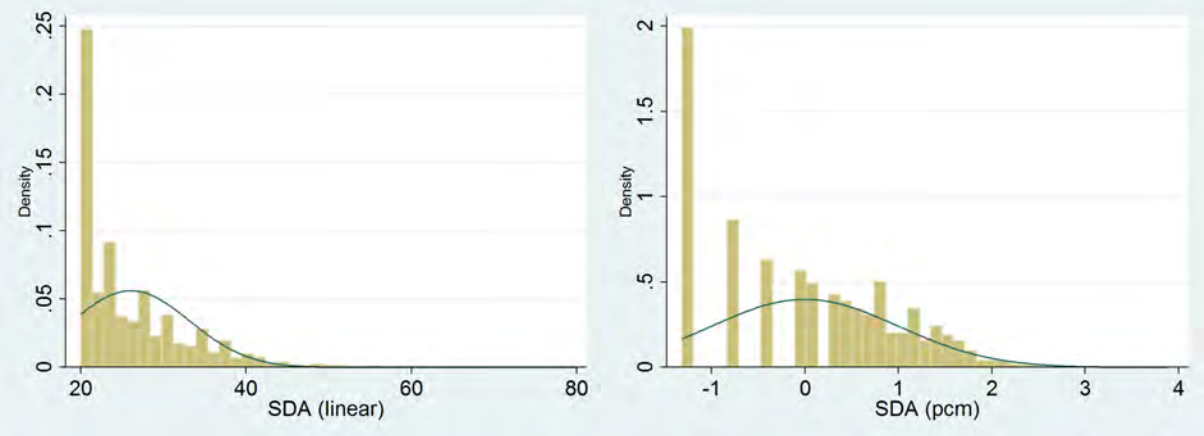
[13]The scale of the Center for Epidemiologic Studies has widely been used and its properties are highlighted in, e.g., Radloff (1977), Roberts (1980) and Weissman et al. (1977).

Figure 1: Category Probability Curves



Source: Authors' calculations based on MxFLS.

Figure 2: Distributions of Symptoms of Depression / Anxiety (SDA) Scale



Source: Authors' calculations based on MxFLS.

individual labour supply possesses positive values and zero otherwise, measuring the extensive margin of labour supply, (b) number of *weeks worked* during the last 12 months and (c) number of *hours worked* in the previous week to the interview, both measuring the intensive margin of labour supply. The variable *working* is not identical to "labour market participation" as usually analysed in the literature because here, registered unemployed individuals are not considered as being working. Registered unemployment is very low in Mexico (approx. 3.3%, Table A1 in the appendix). About 92% of the male sample and 36% of the female sample have been working during the 12 months before the interview. The number of weeks worked in the last 12 months is on average 46 weeks for men and women. Men work on average 45 hours per week and women 36 hours per week (Table A1).

A large number of controls on the individual, household, municipality and state level are included in the regressions. Individual and household level controls are age, living

in a rural area (less than 2,500 inhabitants) as compared to an urban area, belonging to an indigenous group, the educational level (primary education, secondary education, or more than secondary education), household size, household wealth proxied by house ownership and whether or not the family has savings, whether or not the individual has ever changed residence (migrant), and whether or not the respondent has been a victim of a criminal incident in the past, the region in which the respondent lives and whether or not the neighbourhood can be considered deprived, meaning that abandoned buildings are present. One concern could be that in regions with high conflict rates informal employment shares are also high and informal employment is associated with lower labour supply. Descriptive analysis with respect to this relationship does not provide evidence for this, so it is not necessary to control for it. Furthermore, to account for the fact that the death of a household member potentially increases the probability of onset of depression symptoms, a variable is included which is equal to 1 if the respondent has lost a household member due to death in the last 5 years and zero otherwise.

Interviews were conducted from mid to end 2002 and late 2005 to mid 2006. Although these years do not cover a calendar year, homicide rates from the respective calendar years are used. This is not unreasonable because of the fact that mental health is measured via questions which refer to the last 4 weeks before the interview. In studies on determinants of mental well-being it has been shown that the time interval to which the questions on mental well-being refer does not significantly matter (e.g., Oswald and Powdthavee, 2007; Oswald and Wu, 2011). Hence, although the questions on mental health in the MxFLS refer to the last 4 weeks before interview, they can reasonably be matched to data on homicides that cover a longer time span.

4 Results

4.1 Violent Conflicts and Symptoms of Depression and Anxiety

A simple unconditional correlation between SDA and the presence of armed groups in the neighbourhood reveals that those respondents who gave a positive answer (about 10% of the sample) have a statistically significantly higher mean score in the depression variable; it is 26.9 compared to 25.9 for those who do not live in a neighbourhood where armed groups are present.

Table 2 shows the regression results of the effect of intentional homicide rates and the presence of armed groups in the neighbourhood on symptoms of depression / anxiety, controlling for state, municipal, household and individual characteristics. All coefficients have the expected sign and are statistically significant at the 1% level. For men, the results indicate that an increase in intentional homicides by 1 per 100,000 inhabitants is

Table 2: Effect of Violent Conflicts on SDA

	Dependent variable: SDA (pcm)		
	(1)	(2)	(3)
MEN			
Homicides/100,000 inhabitants	0.005***	–	0.005***
	(0.002)		(0.002)
Armed groups neighbourhood	–	0.117***	0.116***
		(0.039)	(0.039)
N	10227	10227	10227
R^2	0.055	0.055	0.056
F	20	20	20
p	0.000	0.000	0.000
Test of joint significance			
χ^2 (2)	–	–	16.88
p	–	–	0.000
WOMEN			
Homicides/100,000 inhabitants	0.005***	–	0.005***
	(0.001)		(0.001)
Armed groups neighbourhood	–	0.094***	0.091***
		(0.032)	(0.032)
N	14733	14733	14733
R^2	0.062	0.061	0.063
F	33	33	32
p	0.000	0.000	0.000
Test of joint significance			
χ^2 (2)	–	–	23.63
p	–	–	0.000

Note: OLS regressions. Standard errors are two-way clustered on individuals and households. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. The other coefficients can be found in Appendix Tables A2 and A3.

associated with an increase in 0.005 standard deviations in SDA, i.e. approximately (5.78 $\times$ 0.005 =) 0.03 points on the linear SDA scale. Stating that armed groups are present in the neighbourhood is associated with 0.117 standard deviations higher level of SDA, i.e. approximately 0.7 points on the linear SDA scale. Including both measures of violent conflicts in the regressions simultaneously does not change the coefficients significantly. For women, the effects are similar to those for men: An increase in intentional homicide rates by 1 per 100,000 inhabitants leads to an increase in symptoms of anxiety / depression by 0.005 and the presence of armed groups is associated with 0.094 standard deviations higher SDA. The result tables including the coefficients of the control variables can be found in the appendix, Tables A2 and A3.

The magnitude of the effects does not seem to by particularly high. However, when comparing the size of the effect of the presence of armed groups in the neighbourhood to the coefficient of having been a victim of violence or robbery within the last five years the magnitude of the effect does not appear marginal. In fact, for men, these effects are similarly strong. Furthermore, having lost a household member within the last five years increases SDA by 0.09 standard deviations. This effect is even smaller than the presence of armed groups in the neighbourhood, although this difference is

not statistically different. The results further show that being indigenous is associated with higher values on the SDA scale, while having obtained a high school or college degree leads to lower levels of SDA. Household size and financial wealth, as indicated by owning a house or having savings, are not associated with SDA on average, however the effects are likely being captured by higher levels of education which is correlated with financial wealth and household size. For women, the effects of having been a victim and having lost a household member within the last five years are also comparable to the presence of armed groups in the neighbourhood. Some other regressors are considerably different though. While indigenous women compared to non-indigenous women do not have different average values on the SDA scale, next to a high school or college degree, owning a house and having savings strongly reduces the average value on the SDA scale.

All in all, these results suggest that both men and women in adult age suffered from the conflicts in 2002 and 2005. Taking into account that only few severely insecure regions are part of the MxFLS, the overall effects are probably even larger than the effects found here for individuals living in areas with low to medium levels of conflict. However, it implies that just the news about another casualty or even the detection of a mass grave is likely to spread anxiety among the Mexican population even when they are not directly affected. Cornaglia and Leigh (2012) also found that solely newspaper covering of criminal events affect adult mental health.

As noted before, homicide statistics are probably underestimated, hence the here estimated effects are lower bounds. Considering that homicide rates have increased dramatically since the beginning of 2008, the impact of homicide rates on SDA does not seem to be so negligible any more. It takes on average 30 killings per 100,000 inhabitants to increase the SDA scale by one point. As an extreme example, in Chihuahua, the state which is home to Ciudad Juárez, one of the world's most dangerous cities directly at the border to the U.S. counted 49.1 intentional homicides per 100,000 inhabitants in 2008 (Shirk, 2010). Assuming all other controls did not change between 2002/2005 and 2008, inhabitants of Ciudad Juárez have on average approximately 1.4 points more on the SDA scale (or approximately 0.25 standard deviations) than individuals in a place with zero killings.

Finally, while these results only demonstrate psychological costs of conflict, looking at the subsequent negative effects of SDA on labour supply will provide insights into the economic consequences of these violent conflicts.

4.2 Mental Health and Labour Supply

Participation

In Table 3, the effect of SDA on labour market status – working vs. not working – for men is presented. The complete regression tables can be found in the appendix (Table A4). All the coefficients are marginal effects and are obtained from different regressions. Column 1 shows the estimates from simple Probit models. A negative correlation between SDA and the probability to be working is found and is statistically significant. This effect is very small. It indicates that an increase on the SDA scale by 1 standard deviation is associated with a reduction of the probability to work by 1 percentage point. In columns IV (1) and IV (2) mental health is instrumented with intentional homicide rates and the indicator for armed groups in the neighbourhood, respectively, and with both variables in the last column.

The coefficients are only significant when using homicide rates as an instrument and when using two instruments. An overidentification test based on the Amemiya-Lee-Newey minimum 2-statistic (obtained from the two-step rather than the MLE method)[14] indicates that the instruments are valid. For men, the causal effects are much larger than the conditional correlation estimated in the Probit model. Based on the findings with two instruments, an increase in SDA by 1 standard deviation lowers the probability to be working by 26 percentage points. In other words, an increase in the linear scale (which takes the values 20 to 80) by 5.78 points, or 30 percentage points, leads to a lower probability to be working by 26 percentage points. This effect seems very large but it is not when considering that an increase by 1 homicide per 100,000 inhabitants increases SDA by 0.03 points. Hence, an increase by 1 homicide per 100,000 inhabitants leads via an increase in SDA by 0.03 points to a decrease in the probability to be working by (26 / 5.78 =) 4.5 percentage points. Furthermore, it has to be kept in mind that this effect is the weighted average treatment effect for the subpopulation of compliers. The impression is that few individuals are very responsive in their mental health to conflict intensity and become completely unable to work.

For women, neither a correlation nor a causal effect of mental health on participation is found (see Table A6). The latter finding is not surprising as women often do not actively participate in the labour market for other reasons than health issues, such as the number and age of their children. Since the effect for men is large and men are usually the main contributors to household income in Mexico, the findings are also economically relevant and indicate the severe effect that the conflict indirectly has on labour market participation.

Labour Supply

[14] Unfortunately, there is currently no test implemented in Stata for the MLE model. In the next section it will also be shown that the instruments are strong for men, while they are not for women, at least not in the linear case. A weak instrument test for non-linear models could not be found.

Table 3: Effect of SDA on Participation – Men

	Probit	IV-Probit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.010***	-0.311***	-0.173	-0.260***^{A}
	(0.003)	(0.066)	(0.108)	(0.068)
N		10227		

Note: SDA: Symptoms of depression/anxiety. Each coefficient is obtained from a different regression. The numbers are marginal effects. Standard errors are clustered on the individual level. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = intentional homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, a test for overidentification is pursued. The test statistic is the Amemiya-Lee-Newey minimum χ^2-statistic (obtained from the two-step rather than the MLE method) and ^{A} indicates that $p > 0.1$, i.e. instruments are valid.

As shown in the previous section, mental illness restrains some men from working and hence from actively contributing to household income. The measure of mental health does not only measure whether a person is severely depressed but also whether a person is anxious or 'just' unhappy. An increase in the level of SDA may not lead to the complete drop out of the labour market, but can lead to periods in which the affected person is not able to work. These periods could have the length of several weeks or only a day, or just one or two hours in the morning, when the person feels, for instance, unable to get out of bed. When a person feels too anxious to walk home from work when it is dark, this could also reduce the number of hours worked per day. Furthermore, seasonal labour migrants may decide that it is too dangerous to travel to a remote workplace, reducing the number of job opportunities, and hence the number of weeks worked. Several other circumstances can be imagined.

Table 4: Effect of SDA on Weeks Worked – Men

Linear Regression	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.820***	-16.240**	-9.579*	-12.676***^{A}
	(0.136)	(7.364)	(5.282)	(4.341)
A-P First stage χ^2	–	7.300^{+}	7.827^{+}	7.225^{+}
N		9444		
Tobit Regression	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-1.306***	-28.397***	-16.616***	-22.130***
	(0.198)	(5.468)	(5.473)	(3.954)
N		10227		

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. The coefficients from the Tobit and IV-Tobit models are marginal effects for E(y|x, y>0). IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): $\chi^2 >$ Stock/Yogo's (2005) critical value (25% maximal IV size).

The regression results for men are shown in Table 4 for the dependent variable *weeks worked*. The results of the first row can also be found in the Appendix in Table A5, which additionally displays the coefficients of the control variables and more regression statistics. The OLS coefficients provide evidence for a negative correlation between SDA and the number of weeks worked. Specifically, a 1 standard deviation increase on the scale is associated with 0.820 fewer weeks per year worked.

Columns 2 to 4 display the results from the IV models which allow a causal interpretation of the SDA coefficient. Using intentional homicide rates (IV 1) to instrument SDA, the coefficient is much larger than in the OLS regression. An increase in the SDA scale by 1 standard deviation leads to 16.24 fewer weeks worked. As explained in the methodology section, this effect is the marginal treatment effect for the compliers, i.e. it is the average effect for individuals who respond to conflict with higher SDA. Hence, the effect cannot be interpreted as the impact of deterioration in mental health on the average labour supply in the (sample) population but only for a subpopulation of compliers. The existence of a subpopulation for which the conflict indirectly reduces labour supply via deterioration in mental health is an important finding, even though it is not externally valid for the entire population.

Using the presence of armed groups in the neighbourhood as an instrument, the coefficient measures the LATE: An increase by 1 standard deviation in SDA leads to 9.6 fewer weeks worked for the compliers. Although in both models with just one instrument the instrument is strong and the coefficient is statistically significant, it is worth to estimate the effect of SDA on labour supply using both instruments jointly. This increases the number of compliers and leads to more reliable estimates, given the overidentifying restrictions are valid which is indicated by ^{A} in Table 4. The model with two instruments provides the best model statistics, i.e. the overidentifying restrictions are valid and the instruments are strong and, as shown above, jointly statistically significant in the first stage. Based on this model, an increase by 1 standard deviation in SDA scale leads to 12.7 fewer weeks worked. In other words, this means that an increase in the linear SDA scale by one point (for which it takes on average 30 per 100,000 additional intentional homicides) reduces the number of weeks worked by approximately (12.676 / 5.78 =) 2.19.

The coefficients from the Tobit and IV-Tobit models have the same sign and are all statistically significant at the 1% level. They are more than 50% larger in size than the linear IV estimates. The causal effect of an increase of 1 standard deviation in SDA leads to a decrease in the number of weeks worked by 22.13 when using both instruments. These coefficients measure the effect of deterioration in mental health induced by the presence of armed groups in the neighbourhood or an increase in homicide rates for those

persons who react to either or both of these instruments with higher SDA. In comparable numbers, according to the IV-Tobit model an increase in the linear SDA scale by 1 point reduces the number of weeks worked by 3.83.

For women, the conditional correlation obtained from OLS regression is negative but a causal effect cannot be identified. The coefficients are insignificant in the IV and Tobit models and have surprisingly a positive sign in the IV-Tobit models (see Table A7 in the Appendix). However, the model statistics show that the instruments are weak in all models and the overidentifying restrictions are not valid. Hence, no conclusion can be made about the impact of mental illness on women's labour supply using the instruments chosen. The instruments may not be relevant for women because (1) the number of observations is too small and/or (2) women's mental health is more reactive to other external and internal influences than men's (Rosenfield, 1989; Piccinelli and Wilkinson, 2000; Sandanger et al., 2004) and the measures of conflict do not lead to more variation in the measurement of SDA in women. As men are more likely to be victims of drug-related conflict the effects may also be more likely to be present in men.

While large labour supply reduction effects can be found with respect to the weeks worked, an increase in SDA is also likely to reduce the number of hours worked. For men, qualitatively similar effects are found when using *hours worked* as the dependent variable. Each instrument is strong and when both instruments are used, the overidentifying restrictions are valid. While the instrument *intentional homicide rates* leads to a high and statistically significant coefficient of -23.5 as a response to an increase in SDA by 1 standard deviation, including the other instrument leads to a smaller, still negative but statistically insignificant coefficient. Again, the results from the model with two instruments provide the best model statistics and are used for interpretation. The IV regression results reveal that an increase in SDA by 1 standard deviation leads to an average of 14.6 fewer hours worked in the previous week for compliers. The results from IV-Tobit models are – as with *weeks worked* – about 50% larger than with linear IV regressions. When controlling for the fact that some individuals do not supply labour due to symptoms of depression / anxiety or other reasons, i.e. the extensive margin, for those individuals who supplied at least one hour of labour in the previous week, an increase in SDA leads to 22.4 fewer hours in the previous week for the subpopulation of compliers. Hence, an increase by 30 per 100,000 homicides leads to a reduction in hours worked by 3.88 via an increase in the linear SDA scale by one point. This is approximately 10% of the average number of hours worked in Mexico in 2002 and 2005.[15] For women, causal effects cannot be identified using *hours worked* for reasons similar to those associated with *weeks*

[15]According to OECD statistics (http://stats.oecd.org/Index.aspx?DataSetCode=ANHRS), average annual hours worked per person were 1,888 in 2002 and 1,909 in 2005, which is about 36-37 hours per week.

worked.

Table 5: Effect of SDA on Hours Worked – Men

Linear Regression	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.645***	-23.539**	-5.278	-14.625**^{A}
	(0.188)	(11.672)	(7.509)	(6.616)
A-P First stage χ^2	–	6.265^{+}	5.822^{+}	5.753^{+}
N		9288		
Tobit Regression	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-1.204***	-35.833***	-10.309*	-22.243***
	(0.221)	(6.715)	(6.079)	(4.469)
N		10279		

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): $\chi^2 >$ Stock/Yogo's (2005) critical value (25% maximal IV size).

The effects found for men are large and imply a considerable impact of SDA on the intensive margin of labour supply and thus labour income. Since men are usually the household head and the main household income contributors, an increase in the level of anxiety consequently has negative impacts on household expenditure. Given that poverty is still very high in Mexico, reduced household income induced by mental illness can have considerable consequences for poor families.

5 Robustness Checks

Several robustness checks have been conducted. First, in the model where the presence of armed groups in the neighbourhood serves as an instrument, state dummies are included in the model to account for state fixed effects which could potentially affect labour supply through labour demand patterns which may be related to violent conflicts and are not captured by the macro variables already included. The results do not significantly change by including state dummies.

All models are estimated using homicide statistics on the municipality level (from INEGI). As explained earlier, these data cover only urban areas and only overlap partly with the MxFLS. While this imposes more variation in the conflicts measure, a loss of more than half of the observations hinders the detection of statistically significant results. In fact, in some cases the effect of SDA on labour supply is rendered insignificant.

However, the overall picture still suggests a strong impact of deterioration in mental health on labour supply induced by an increase in homicide rates.

For robustness and different interpretation purposes, different versions of the SDA scale are calculated and used to estimate the effect of violent conflicts on SDA and the subsequent effect of SDA on individual labour supply. The three versions of the SDA scale are: (1) the linear additive (linear), ranging from 20 to 80 with equal weights, (2) the linear version divided into percentiles (perc) and (3) a principal-component factor (pcf) obtained from factor analysis. All results are almost identical to those obtained from the partial-credit Rasch model version of the SDA scale (pcm) and can be obtained from the author on request.

6 Conclusion

Active participation in the labour market and labour supply are usually the main determinants of household income. Whether an individual can participate and how much an individual can work is affected by his or her mental health status. In this study the effect of symptoms of depression / anxiety (SDA) – a main determinant of mental health – on participation and labour supply, i.e. the extensive and intensive margin of labour supply, is estimated using the Mexican Family Life Survey for the years 2002 and 2005.

The estimation of a causal effect of mental health on labour supply is hampered by reverse causality: Better mental health does not only increase the probability to work or the number of weeks per year or hours per week; higher levels of mental health are also affected by actively participating in the labour market, since a job is usually associated with social interaction, structured time schedules and labour income. To overcome the problem of reverse causality, mental health is instrumented by two new instruments which refer to the ongoing violent conflicts in Mexico. Drug-trafficking organisations are fighting over trafficking routes into the U.S. and increasingly over domestic markets. With the local and federal police, and recently also the military, being involved in the 'fight against drugs', various crimes are being committed in Mexico which directly and indirectly affect civil population.

The instruments which measure exposure to violent conflicts are (1) *intentional homicide rates* which are measured on the state level (macro indicator, continuous variable) and (2) *the presence of armed groups in the neighbourhood* (micro indicator, binary variable). Most of the interviewed individuals are unlikely to have lost a household member or experienced injury due to the violent conflicts directly (which would directly affect labour supply). Rather, cases of homicides are read and heard about in the news, and the presence of armed groups in the neighbourhood spreads anxiety and may even lead

to depression symptoms. To control for the fact that these measures could directly affect labour supply, various regional economic indicators are included in the regressions, additionally to personal and household characteristics and whether individuals were directly affected. The validity of the instruments is also given due to the fact that labour demand shocks are uncorrelated with conflict intensity during the investigated time span. This is demonstrated in several ways.

The findings are based on IV-Probit and IV-Tobit models which are estimated for the dependent variables labour market participation, the number of weeks worked in the previous year and the number of hours worked in the previous weeks. The results provide strong evidence for a negative effect of violent conflicts on mental health for both men and women. For men, an increase in SDA by 1 standard deviation is associated with a significantly lower probability of 23 percentage points to be active in the labour market. In other words, an increase by 1 homicide per 100,000 inhabitants in a state increases symptoms of anxiety / depression by 0.03 points (on a scale from 20 to 80) which in turn reduces the probability to be working by 4.5 percentage points. Furthermore, an increase on the linear SDA scale by 1 point leads to 3.83 fewer weeks worked in the previous year and 3.88 fewer hours worked in the last week. The effects are large and statistically significant. The causal effects identified are valid for a subpopulation of compliers, i.e. those men who respond to changes in the conflict measures with higher SDA. Hence, the identified average treatment effects are not the average effects for the whole (sample) population, but they demonstrate that for a part of the population, the conflict directly affects mental health and consequently has detrimental impacts on labour market participation and labour supply. For women, a causal effect of SDA on labour supply cannot be identified, which may be due to weak instruments and the fact that women's mental health responds to other influences than conflict intensity more strongly than men's. It is also not surprising that men are more responsive to the ongoing violent conflict because they are more likely to be victims.

Mexico's violent conflicts cause collective harm to the country's population. With many families in Mexico still being poor, a reduction in labour supply may have considerable consequences for household income. Since men are usually the main contributors to household income, a decrease in labour supply reduces household expenditure which subsequently affects Mexico's economic growth. An increase in SDA and a reduction in labour supply also affect social development in the long run since children of mentally ill parents are likely to suffer not only from reduced income but also from hampered personal interaction. Hence, deterioration in mental health does not only incur monetary costs in terms of reduced labour income through a reduction in individual labour supply but also non-monetary costs on dependent children and other family members in the

environment of the mentally ill person. From a policy perspective, apart from addressing drug-related crime more effectively, the provision of psychological counselling services for those suffering from anxiety or even depression seems to be an essential tool to counteract symptoms of anxiety and depression. Whether that is also a tool against reduced labour supply or whether reduced street insecurity is the only way to counteract the adverse productivity effects, unfortunately, exceeds the scope of this study. However, financial support should be provided for those families whose income is sufficiently low due to the problems associated with mental ill-health.

The data only represent the years 2002 and 2005 – years in which organised crime and death rates have been considerably high. However, with the start of Felipe Calderon's presidency in 2006, the military entered the streets to "fight the war on drugs". Since the beginning of 2008, homicides have increased dramatically. Furthermore, violence has reached other dimensions – children were involved recently in an event to spread terror by parties involved in the "drug war" (The New York Times, 2011). The increasing number and severity of the events is likely to increase the onset of symptoms of depression / anxiety even more – with consequences for labour supply – among others.

Finally, it has to be noted that the author does not claim that the instruments are universally applicable in the analysis of relationships between conflict and labour markets and that the results are externally valid. At times of higher conflict intensity labour supply could directly be linked to the conflict. Furthermore, as the situation in some parts of Mexico has escalated since 2008, imposing higher levels of national insecurity, worse effects on mental health and labour supply than shown in this study may be found.

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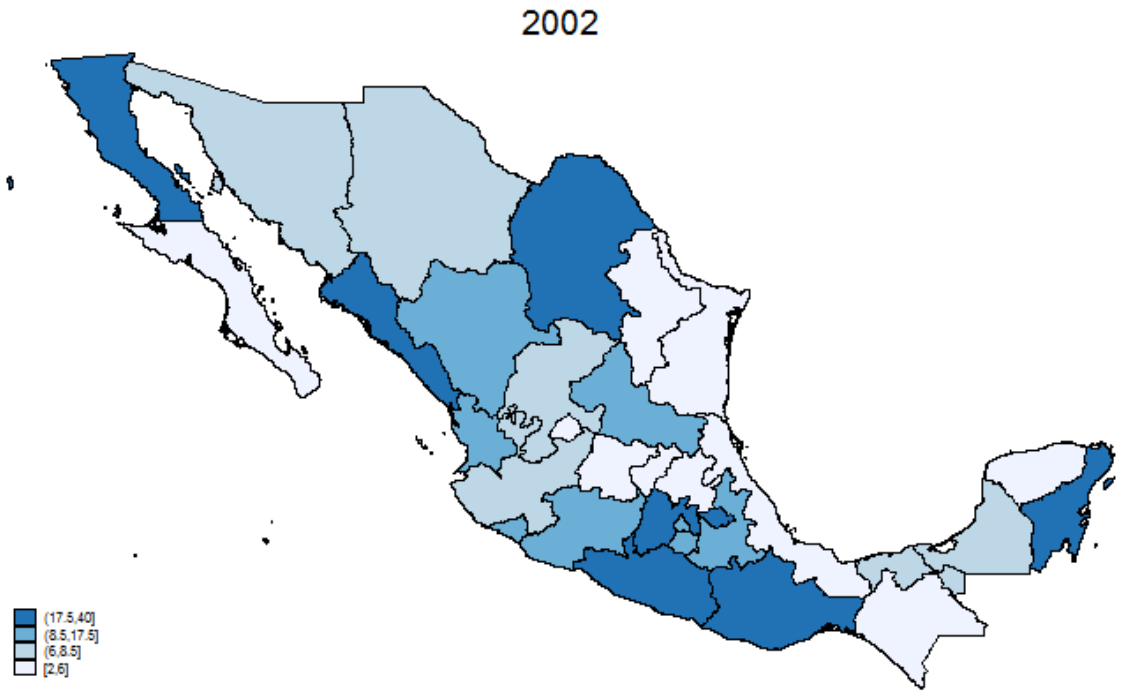
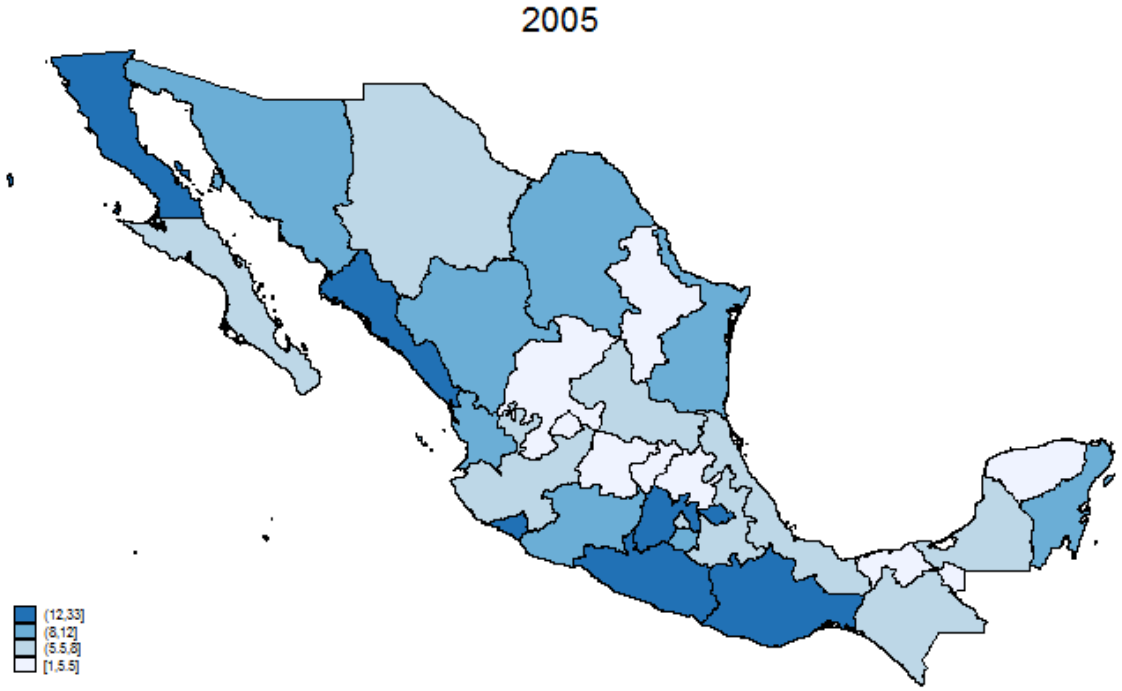
Appendix

Figure A1: Intentional Homicide Rates 2002*



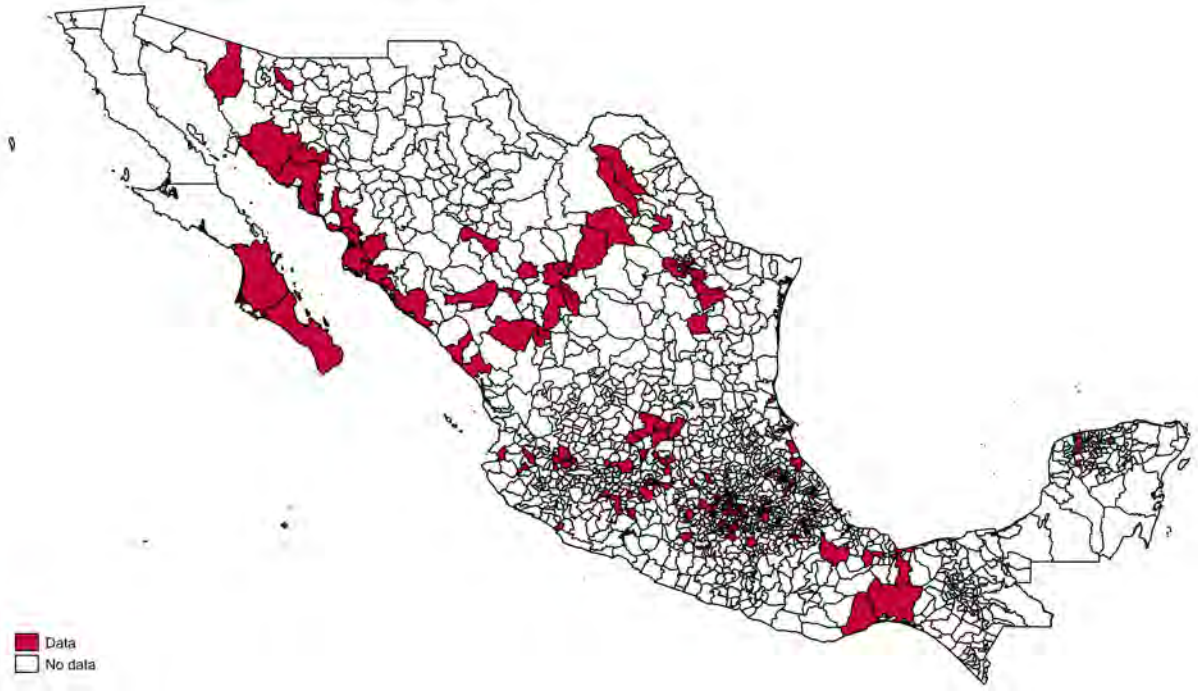
* per 100,000 inhabitants. Author's construction using data from ICESI.

Figure A2: Intentional Homicide Rates 2005*



* per 100,000 inhabitants. Author's construction using data from ICESI.

Figure A3: Municipalities in which Interviews Have Been Conducted



Author's construction based on MxFLS.

Table A1: Descriptive Statistics

	Men				Women			
	Mean	Std.Dev.	Min	Max	Mean	Std.Dev.	Min	Max
Dependent variables								
Working	0.92	0.27	0	1	0.36	0.48	0	1
Weeks worked previous year	46.86	11.84	0	52	45.82	13.64	0	52
Hours worked previous week	44.79	17.29	0	84	36.43	19.40	0	84
SDA Scales								
SDA (pcm)	0	1	-1.11	4.54	0	1	-1.52	3.68
SDA (linear)	24.14	5.78	20	80	27.39	7.61	20	80
SDA (perc)	36.31	30.35	1	100	52.42	32.04	1	100
SDA (pcf)	0.00	1.00	-0.69	9.83	0.00	1.00	-0.94	7.01
Instruments								
Homicides/100,000 inhabitants	10.97	8.13	1.20	40.28	11.12	8.54	1.20	40.28
Armed groups neighbourhood	0.09	0.29	0	1	0.10	0.30	0	1
Individual Characteristics								
Age	38.76	12.21	20	65	38.38	12.09	20	65
Indigenous	0.12	0.33	0	1	0.12	0.32	0	1
High school	0.08	0.28	0	1	0.08	0.27	0	1
College	0.10	0.30	0	1	0.06	0.24	0	1
House owner	0.81	0.40	0	1	0.80	0.40	0	1
Savings	0.24	0.42	0	1	0.23	0.42	0	1
HH size	9.69	4.56	1	37	9.73	4.50	1	37
Children < 2 in HH	0.28	0.45	0	1	0.28	0.45	0	1
Migrant	0.28	0.45	0	1	0.32	0.47	0	1
Death of HH member	0.08	0.28	0	1	0.08	0.28	0	1
Victim	0.13	0.34	0	1	0.07	0.26	0	1
Rural	0.40	0.49	0	1	0.40	0.49	0	1
North-West	0.22	0.42	0	1	0.21	0.40	0	1
North-East	0.20	0.40	0	1	0.20	0.40	0	1
South	0.20	0.40	0	1	0.20	0.40	0	1
West	0.20	0.40	0	1	0.20	0.40	0	1
Central	0.16	0.37	0	1	0.17	0.37	0	1
Federal District	0.02	0.14	0	1	0.02	0.14	0	1
Regional characteristics								
Deprived neighbourhood	0.41	0.49	0	1	0.41	0.49	0	1
Emigration rate	0.12	0.11	-0.13	0.40	0.11	0.08	-0.09	0.33
UR, registred	3.31	1.24	0.63	6.15	3.28	1.26	0.63	6.15
UR, unregistered	14.50	5.77	6.25	27.13	14.50	5.67	6.25	27.13
HDI health	0.85	0.06	0.59	0.99	0.85	0.06	0.59	0.97
HDI education	0.82	0.06	0.50	0.90	0.82	0.06	0.50	0.90
HDI income	0.69	0.10	0.23	0.88	0.69	0.10	0.23	0.88
N	10227				14733			

Note: UR = unemployment rate.

Table A2: Effect of Violent Conflicts on SDA - Men

	Dependent variable: SDA (pcm)		
	(1)	(2)	(3)
Homicides/100,000 inhabitants	0.005***	–	0.005***
	(0.002)		(0.002)
Armed groups neighbourhood	–	0.117***	0.116***
		(0.039)	(0.039)
Age	-0.012**	-0.013**	-0.013**
	(0.006)	(0.006)	(0.006)
Age sqrd	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Indigenous	0.079**	0.068*	0.079**
	(0.037)	(0.036)	(0.037)
High school	-0.106***	-0.111***	-0.109***
	(0.036)	(0.036)	(0.036)
College	-0.175***	-0.178***	-0.175***
	(0.034)	(0.034)	(0.034)
House owner	-0.004	0.002	-0.004
	(0.028)	(0.028)	(0.028)
Savings	-0.032	-0.039	-0.035
	(0.026)	(0.026)	(0.026)
HH size	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)
Rural	-0.082***	-0.082***	-0.079***
	(0.028)	(0.028)	(0.028)
Death of HH member	0.091**	0.093**	0.090**
	(0.037)	(0.037)	(0.037)
Year 2005	-0.049*	-0.055**	-0.047*
	(0.027)	(0.027)	(0.027)
Victim	0.186***	0.192***	0.186***
	(0.031)	(0.031)	(0.031)
Children < 2 in HH	-0.050**	-0.049*	-0.049**
	(0.025)	(0.025)	(0.025)
Migrant	0.006	0.004	0.005
	(0.024)	(0.024)	(0.024)
Regional dummies	Yes	Yes	Yes
Regional characteristics	Yes	Yes	Yes
Constant	Yes	Yes	Yes
N	10227	10227	10227
R^2	0.055	0.055	0.056
F	20	20	20
p	0.000	0.000	0.000
Test of joint significance			
χ^2 (2)	–	–	16.88
p	–	–	0.000

Note: Standard errors are two-way clustered on individuals and households. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively.

Table A3: Effect of Violent Conflicts on SDA - Women

	Dependent variable: SDA (pcm)		
	(1)	(2)	(3)
Homicides/100,000 inhabitants	0.005***	–	0.005***
	(0.001)		(0.001)
Armed groups neighbourhood	–	0.094***	0.091***
		(0.032)	(0.032)
Age	0.004	0.003	0.004
	(0.005)	(0.005)	(0.005)
Age sqrd	0.000*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)
Indigenous	0.041	0.036	0.043
	(0.031)	(0.032)	(0.031)
High school	-0.177***	-0.175***	-0.175***
	(0.031)	(0.031)	(0.031)
College	-0.338***	-0.337***	-0.339***
	(0.034)	(0.034)	(0.034)
House owner	-0.087***	-0.081***	-0.086***
	(0.024)	(0.024)	(0.024)
Savings	-0.047**	-0.054**	-0.050**
	(0.023)	(0.023)	(0.023)
HH size	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
Rural	-0.079***	-0.079***	-0.077***
	(0.024)	(0.024)	(0.024)
Death of HH member	0.114***	0.114***	0.111***
	(0.031)	(0.031)	(0.031)
Year 2005	-0.039*	-0.047**	-0.039*
	(0.023)	(0.023)	(0.023)
Victim	0.181***	0.188***	0.180***
	(0.033)	(0.033)	(0.033)
Children < 2 in HH	-0.035	-0.033	-0.034
	(0.022)	(0.022)	(0.022)
Migrant	0.062***	0.061***	0.062***
	(0.019)	(0.019)	(0.019)
Regional dummies	Yes	Yes	Yes
Regional characteristics	Yes	Yes	Yes
Constant	Yes	Yes	Yes
N	14733	14733	14733
R^2	0.062	0.061	0.063
F	33	33	32
p	0.000	0.000	0.000
Test of joint significance			
χ^2 (2)	–	–	23.63
p	–	–	0.000

Note: Standard errors are two-way clustered on individuals and households. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively.

Table A4: Effect of SDA on Participation – Men

	Probit	IV-Probit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.010***	-0.311***	-0.173	-0.260***
	(0.003)	(0.066)	(0.108)	(0.068)
Age	0.012***	0.009**	0.012***	0.011***
	(0.001)	(0.004)	(0.002)	(0.003)
Age sqrd	-0.000***	-0.000	-0.000***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Indigenous	0.009	0.030**	0.021	0.028**
	(0.008)	(0.013)	(0.013)	(0.013)
High school	-0.008	-0.042***	-0.028	-0.038**
	(0.010)	(0.016)	(0.019)	(0.016)
College	-0.003	-0.059***	-0.034	-0.051**
	(0.010)	(0.019)	(0.025)	(0.020)
House owner	-0.015**	-0.016	-0.019**	-0.018*
	(0.007)	(0.011)	(0.009)	(0.011)
Savings	0.009	-0.001	0.006	0.002
	(0.006)	(0.011)	(0.009)	(0.010)
HH size	-0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Children < 2 in HH	0.018***	0.006	0.015*	0.011
	(0.006)	(0.012)	(0.009)	(0.011)
Migrant	0.007	0.010	0.010	0.010
	(0.006)	(0.010)	(0.008)	(0.009)
Death of HH member	-0.020**	0.009	-0.007	0.002
	(0.010)	(0.017)	(0.015)	(0.016)
Victim	0.005	0.059***	0.034	0.050***
	(0.008)	(0.017)	(0.022)	(0.016)
Rural	-0.003	-0.029**	-0.018	-0.024**
	(0.007)	(0.012)	(0.013)	(0.012)
Deprived neighbourhood	0.001	0.040***	0.022	0.033***
	(0.005)	(0.012)	(0.016)	(0.012)
Central	0.037**	0.024	0.038	0.033
	(0.015)	(0.036)	(0.026)	(0.032)
Emigration rate	0.048*	0.096**	0.083*	0.094**
	(0.028)	(0.044)	(0.042)	(0.043)
Unemployment rate, registred	0.002	-0.004	-0.001	-0.003
	(0.003)	(0.005)	(0.004)	(0.005)
Unemployment rate, unregistered	0.000	-0.001*	-0.001	-0.001
	(0.000)	(0.001)	(0.001)	(0.001)
HDI health	0.047	0.107	0.093	0.102
	(0.090)	(0.143)	(0.126)	(0.137)
HDI education	-0.071	-0.224	-0.171	-0.204
	(0.090)	(0.144)	(0.138)	(0.141)
HDI income	0.157**	0.015	0.110	0.060
	(0.062)	(0.115)	(0.096)	(0.105)
Year 2005	-0.021***	-0.038***	-0.034***	-0.038***
	(0.006)	(0.010)	(0.011)	(0.010)
Regional dummies	Yes	Yes	Yes	Yes
N	10227	10227	10227	10227
χ^2	194	2664	578	1411
p	0.000	0.000	0.000	0.000

Note: The coefficients are marginal effects. Standard errors are clustered on individuals. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1% respectively. IV (1) = murder rates on state level, IV (2) = armed groups in neighborhood.

Table A5: Effect of Mental Health on Weeks Worked – Men

	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.820***	-16.240**	-9.579*	-12.676***
	(0.136)	(7.364)	(5.282)	(4.341)
Age	0.555***	0.398***	0.466***	0.432***
	(0.077)	(0.133)	(0.105)	(0.108)
Age sqrd	-0.006***	-0.002	-0.004**	-0.003*
	(0.001)	(0.002)	(0.002)	(0.002)
Indigenous	0.014	0.869	0.500	0.645
	(0.428)	(0.792)	(0.577)	(0.624)
High school	0.624	-0.972	-0.282	-0.605
	(0.419)	(1.022)	(0.757)	(0.742)
College	0.915**	-1.395	-0.397	-0.877
	(0.355)	(1.239)	(0.912)	(0.821)
House owner	-0.659**	-0.601	-0.626	-0.613
	(0.309)	(0.511)	(0.386)	(0.440)
Savings	0.506*	-0.039	0.196	0.076
	(0.285)	(0.531)	(0.405)	(0.431)
HH size	-0.000	-0.009	-0.005	-0.006
	(0.034)	(0.053)	(0.041)	(0.046)
Children < 2 in HH	0.002	-0.791	-0.449	-0.612
	(0.306)	(0.597)	(0.454)	(0.461)
Migrant	-0.194	-0.115	-0.149	-0.135
	(0.278)	(0.442)	(0.338)	(0.382)
Death of HH member	-1.544***	-0.302	-0.839	-0.612
	(0.514)	(0.965)	(0.717)	(0.745)
Victim	-1.273***	1.387	0.238	0.774
	(0.390)	(1.404)	(1.027)	(0.915)
Rural	-1.733***	-2.908***	-2.400***	-2.646***
	(0.335)	(0.745)	(0.569)	(0.551)
Deprived neighbourhood	-0.057	1.715*	0.949	1.306**
	(0.263)	(0.949)	(0.688)	(0.622)
Central	-1.084	-2.155	-1.692	-1.922
	(0.757)	(1.504)	(1.066)	(1.221)
Emigration rate	-0.149	2.772	1.510	2.108
	(1.479)	(2.602)	(2.005)	(2.101)
Unemployment rate, registred	0.389***	0.117	0.234	0.188
	(0.146)	(0.265)	(0.195)	(0.211)
Unemployment rate, unregistered	-0.082***	-0.149***	-0.120***	-0.134***
	(0.025)	(0.050)	(0.038)	(0.039)
HDI health	-5.843	-2.503	-3.946	-2.892
	(5.115)	(7.603)	(6.127)	(6.676)
HDI education	-9.999**	-18.372**	-14.755**	-16.893**
	(4.840)	(7.967)	(6.559)	(6.718)
HDI income	16.610***	10.129*	12.928***	11.524***
	(3.185)	(5.434)	(4.272)	(4.403)
Year 2005	-0.201	-1.010	-0.661	-0.835
	(0.359)	(0.649)	(0.509)	(0.521)
Constant	38.986***	47.509***	43.827***	45.713***
	(3.623)	(6.777)	(5.309)	(5.411)
Regional dummies	Yes	Yes	Yes	Yes
N	9444	9444	9444	9444
R^2 centered	0.042	-1.298	-0.390	-0.750
R^2 uncentered	0.943	0.862	0.917	0.895
F	13	5	8	7
p	0.000	0.000	0.000	0.000
A-P First stage χ^2	–	7.300	7.827	7.225
Shea's r^2		0.001	0.001	0.002
Hansen's J	0.000	0.000	0.000	0.570
H's J-p	–	–	–	0.450

Note: Standard errors are bootstrapped with 400 replications. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood.

Table A6: Effect of SDA on Participation – Women

	Probit	IV-Probit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	0.004	0.193**	0.160	0.181**^{A}
	(0.004)	(0.095)	(0.139)	(0.081)
N	14733			

Note: Each coefficient is obtained from a different regression. The numbers are marginal effects. Standard errors are clustered on the individual level. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, a test for overidentification is pursued. The test statistic is the Amemiya-Lee-Newey minimum χ^2-statistic (obtained from the two-step rather than the MLE method) and ^{A} indicates that $p > 0.1$, i.e. instruments are valid.

Table A7: Effect of SDA on Weeks Worked – Women

Linear Regression	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.564***	11.503	-1.770	3.802
	(0.199)	(13.733)	(8.566)	(7.108)
A-P First stage χ^2	–	1.744	2.316	1.942
N	5262			
Tobit Regression	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	0.060	9.210**	5.632	7.847**
	(0.163)	(4.149)	(5.128)	(3.235)
N	14780			

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): $\chi^2 >$ Stock/Yogo's (2005) critical value (25% maximal IV size).

Table A8: Effect of SDA on Hours Worked – Men

	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.645***	-23.539**	-5.278	-14.625**
	(0.188)	(11.672)	(7.509)	(6.616)
Age	0.454***	0.221	0.407***	0.303**
	(0.099)	(0.195)	(0.129)	(0.141)
Age sqrd	-0.006***	-0.001	-0.005**	-0.003
	(0.001)	(0.003)	(0.002)	(0.002)
Indigenous	-0.977*	0.235	-0.732	-0.246
	(0.587)	(1.141)	(0.720)	(0.820)
High school	-0.945	-3.113**	-1.384	-2.290**
	(0.610)	(1.490)	(0.949)	(1.000)
College	-3.394***	-6.735***	-4.070***	-5.460***
	(0.620)	(1.949)	(1.278)	(1.233)
House owner	-1.260***	-1.301*	-1.268***	-1.284**
	(0.450)	(0.752)	(0.465)	(0.581)
Savings	0.958**	0.004	0.765	0.390
	(0.431)	(0.870)	(0.545)	(0.622)
HH size	-0.079*	-0.105	-0.084*	-0.095
	(0.044)	(0.077)	(0.047)	(0.059)
Children < 2 in HH	0.029	-1.163	-0.212	-0.681
	(0.406)	(0.924)	(0.569)	(0.630)
Migrant	-0.211	-0.236	-0.216	-0.235
	(0.403)	(0.657)	(0.418)	(0.514)
Deprived neighbourhood	-0.258	2.442	0.289	1.385
	(0.365)	(1.510)	(0.951)	(0.908)
Death of HH member	0.132	1.988	0.508	1.248
	(0.632)	(1.405)	(0.882)	(0.959)
Victim	0.671	4.657**	1.478	3.118**
	(0.524)	(2.201)	(1.429)	(1.333)
Rural	-1.999***	-3.542***	-2.311***	-2.889***
	(0.457)	(1.106)	(0.676)	(0.740)
Central	-0.576	-2.049	-0.874	-1.579
	(1.544)	(2.644)	(1.705)	(2.051)
Emigration rate	0.168	3.894	0.922	2.295
	(1.908)	(3.735)	(2.281)	(2.691)
HDI health	-7.173	-0.137	-5.749	-2.090
	(6.364)	(10.737)	(6.988)	(8.207)
HDI education	23.321***	9.904	20.606***	14.691*
	(6.324)	(12.051)	(7.919)	(8.892)
HDI income	1.874	-8.136	-0.151	-4.372
	(4.075)	(8.269)	(5.367)	(5.907)
Unemployment rate, registred	0.245	-0.207	0.154	-0.034
	(0.193)	(0.402)	(0.252)	(0.286)
Unemployment rate, unregistered	-0.005	-0.115	-0.027	-0.071
	(0.033)	(0.078)	(0.049)	(0.053)
Year 2005	-0.405	-1.694*	-0.666	-1.228*
	(0.440)	(0.950)	(0.621)	(0.661)
Constant	28.386***	40.882***	30.914***	36.057***
	(5.005)	(10.217)	(6.563)	(7.291)
Regional dummies	Yes	Yes	Yes	Yes
N	9288	9288	9288	9288
R^2 centered	0.033	-1.624	-0.034	-0.584
R^2 uncentered	0.899	0.725	0.891	0.834
F	10	4	9	6
p	0.000	0.000	0.000	0.000
A-P First stage χ^2	–	6.265	5.822	5.753
Shea's r^2		0.001	0.001	0.002
Hansen's J	0.000	0.000	0.000	2.006
H's J-p	–	–	–	0.157

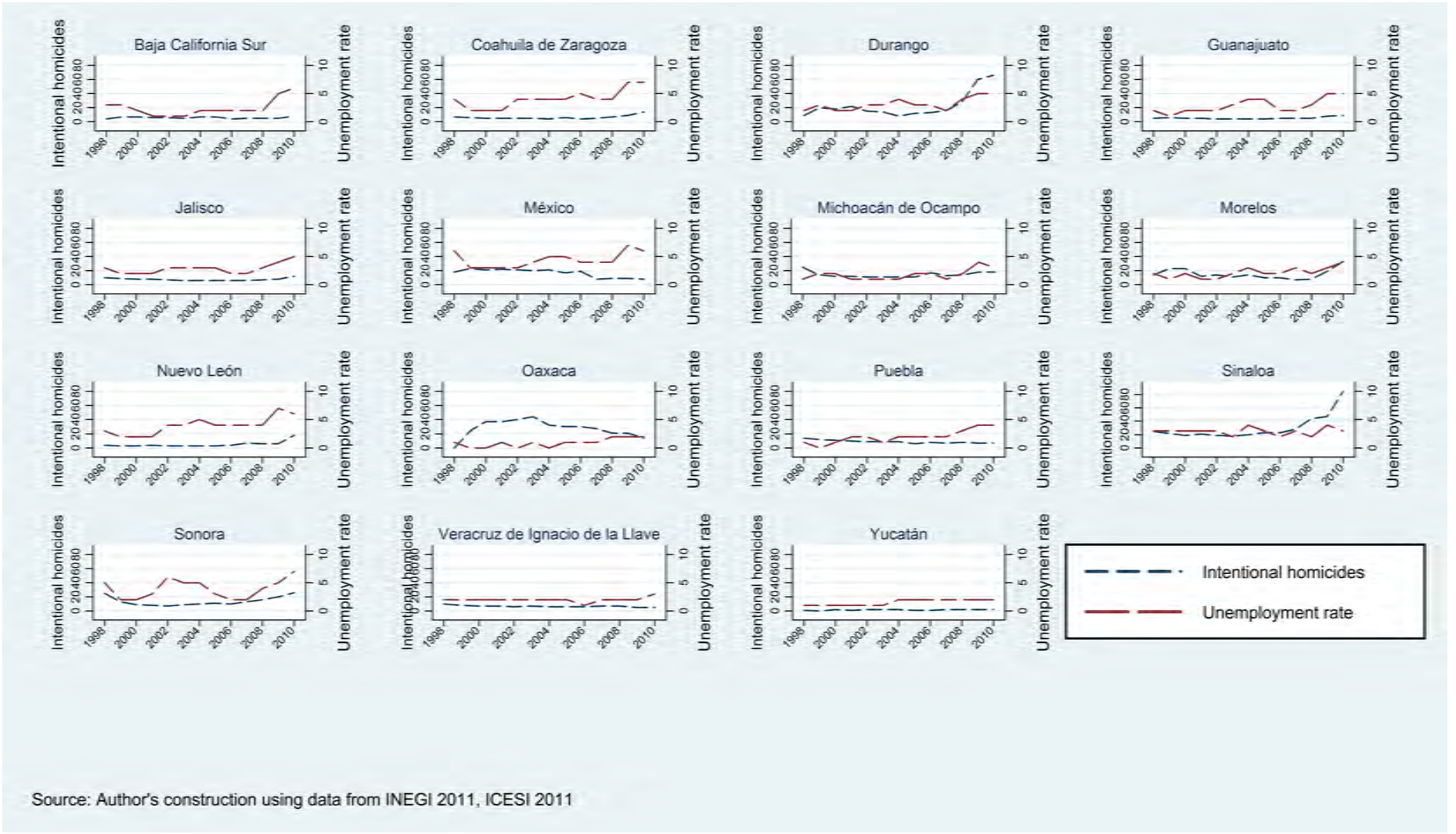
Note: Standard errors are two-way clustered on individual and household level in the OLS, and IV models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood.

Table A9: Effect of SDA on Hours Worked – Women

Linear Regression				
	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.845***	-24.387	-10.517	-16.516
	(0.276)	(22.627)	(13.766)	(12.407)
A-P First stage χ^2	–	1.771	2.157	1.898
N		5169		
Tobit Regression				
	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (pcm)	-0.022	4.170	4.018	4.098
	(0.143)	(3.576)	(4.382)	(2.789)
N		14733		

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): $\chi^2 >$ Stock/Yogo's (2005) critical value (25% maximal IV size).

Figure A4: Unemployment Rates and Homicide Rates over Time by State



Source: Author's construction using data from INEGI 2011, ICESI 2011

Appendix B – not intended for publication

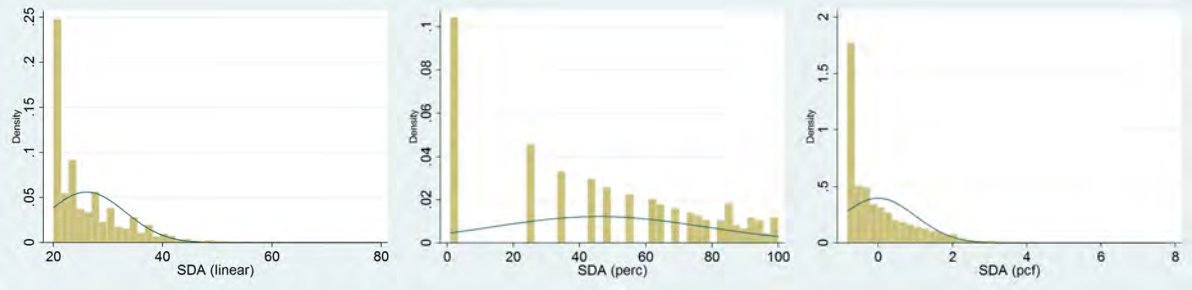
Robustness checks

Table B 1: Robustness Checks: Effect of Violent Conflicts on SDA – Men

	Dependent variable: SDA		
	SDA (linear)	SDA (perc)	SDA (pcf)
Homicides/100,000 inhabitants	0.030***	0.126**	0.005***
	(0.009)	(0.054)	(0.002)
Armed groups neighbourhood	0.639***	3.829***	0.110***
	(0.224)	(1.315)	(0.039)
Age	-0.082**	-0.564***	-0.013**
	(0.033)	(0.193)	(0.006)
Age sqrd	0.002***	0.011***	0.000***
	(0.000)	(0.002)	(0.000)
Indigenous	0.419**	2.446**	0.073**
	(0.210)	(1.227)	(0.036)
High school	-0.618***	-3.298***	-0.107***
	(0.194)	(1.268)	(0.034)
College	-0.840***	-5.815***	-0.146***
	(0.186)	(1.191)	(0.032)
House owner	-0.019	-0.184	-0.005
	(0.156)	(0.960)	(0.027)
Savings	-0.307**	-1.070	-0.051**
	(0.147)	(0.880)	(0.026)
HH size	-0.001	-0.069	-0.000
	(0.015)	(0.095)	(0.003)
Rural	-0.299*	-2.225**	-0.051*
	(0.158)	(0.952)	(0.027)
Death of HH member	0.541**	4.194***	0.097***
	(0.211)	(1.295)	(0.037)
Year 2005	-0.434***	-7.235***	-0.075***
	(0.158)	(0.934)	(0.027)
Victim	1.076***	8.831***	0.182***
	(0.184)	(1.023)	(0.032)
Children < 2 in HH	-0.233*	-1.561*	-0.041*
	(0.138)	(0.856)	(0.024)
Migrant	0.017	-0.057	0.005
	(0.138)	(0.803)	(0.024)
Regional dummies	Yes	Yes	Yes
Regional characteristics	Yes	Yes	Yes
Constant	Yes	Yes	Yes
N	10227	10227	10227
R^2	0.048	0.067	0.044
F	16	25	15
p	0.000	0.000	0.000
Test of joint significance			
χ^2 (2)	17.71	13.52	16.94
p	0.000	0.001	0.000

Note: Standard errors are two-way clustered on on individuals and households. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively.

Figure B1: Distributions of Symptoms of Depression / Anxiety (SDA) Scale



Source: Authors' calculations based on MxFLS.

Table B 2: Robustness Checks: Effect of Violent Conflicts on SDA – Women

	Dependent variable: SDA		
	SDA (linear)	SDA (perc)	SDA (pcf)
Homicides/100,000 inhabitants	0.036***	0.140***	0.005***
	(0.010)	(0.041)	(0.001)
Armed groups neighbourhood	0.820***	3.059***	0.108***
	(0.261)	(1.011)	(0.034)
Age	-0.001	-0.032	-0.000
	(0.037)	(0.149)	(0.005)
Age sqrd	0.001**	0.005**	0.000**
	(0.000)	(0.002)	(0.000)
Indigenous	0.379	1.599*	0.051
	(0.236)	(0.959)	(0.031)
High school	-1.397***	-5.491***	-0.184***
	(0.216)	(0.964)	(0.028)
College	-2.385***	-10.298***	-0.310***
	(0.229)	(1.078)	(0.030)
House owner	-0.550***	-2.427***	-0.070***
	(0.182)	(0.741)	(0.024)
Savings	-0.425**	-1.782**	-0.057**
	(0.172)	(0.704)	(0.023)
HH size	0.010	-0.008	0.002
	(0.017)	(0.072)	(0.002)
Rural	-0.498***	-1.760**	-0.064***
	(0.182)	(0.736)	(0.024)
Death of HH member	0.863***	3.555***	0.112***
	(0.255)	(0.962)	(0.034)
Year 2005	-1.482***	-8.531***	-0.190***
	(0.171)	(0.706)	(0.023)
Victim	1.920***	8.419***	0.251***
	(0.260)	(0.995)	(0.034)
Children < 2 in HH	-0.285*	-1.098	-0.039*
	(0.164)	(0.691)	(0.022)
Migrant	0.353**	1.951***	0.043**
	(0.146)	(0.590)	(0.019)
Regional dummies	Yes	Yes	Yes
Regional characteristics	Yes	Yes	Yes
Constant	Yes	Yes	Yes
N	14733	14733	14733
R^2	0.068	0.080	0.065
F	35	44	33
p	0.000	0.000	0.000
Test of joint significance			
χ^2 (2)	23.48	21.61	23.64
p	0.000	0.000	0.000

Note: Standard errors are two-way clustered on on individuals and households. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively.

Table B 3: Robustness Checks: Effect of SDA on Participation – Men

	Probit	IV-Probit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.002***	-0.051***	-0.031	-0.044***^{A}
	(0.000)	(0.012)	(0.019)	(0.012)
SDA (perc)	-0.000***	-0.010***	-0.005	-0.008***^{A}
	(0.000)	(0.002)	(0.003)	(0.002)
SDA (pcf)	-0.013***	-0.297***	-0.182	-0.257***^{A}
	(0.002)	(0.070)	(0.112)	(0.067)
N	10227			

Note: SDA: Symptoms of depression/anxiety. Each coefficient is obtained from a different regression. The numbers are marginal effects. Standard errors are clustered on the individual level. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, a test for overidentification is pursued. The test statistic is the Amemiya-Lee-Newey minimum χ^2-statistic (obtained from the two-step rather than the MLE method) and ^{A} indicates that $p > 0.1$, i.e. instruments are valid.

Table B 4: Robustness Checks: Effect of SDA on Participation – Women

	Probit	IV-Probit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.000	0.027**	0.018	0.023**^{A}
	(0.001)	(0.013)	(0.016)	(0.011)
SDA (perc)	0.000	0.007**	0.005	0.006**^{A}
	(0.000)	(0.003)	(0.004)	(0.003)
SDA (pcf)	-0.001	0.201**	0.138	0.173**^{A}
	(0.004)	(0.098)	(0.124)	(0.081)
N	14733			

Note: Each coefficient is obtained from a different regression. The numbers are marginal effects. Standard errors are clustered on the individual level. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, a test for overidentification is pursued. The test statistic is the Amemiya-Lee-Newey minimum χ^2-statistic (obtained from the two-step rather than the MLE method) and ^{A} indicates that $p > 0.1$, i.e. instruments are valid.

Table B 5: Robustness Checks: Effect of SDA on Weeks Worked – Men

Linear Regression				
	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.108***	-2.500**	-1.501*	-1.973***^{A}
	(0.022)	(1.126)	(0.834)	(0.678)
A-P First stage χ^2	–	9.376^{+}	9.074^{+}	8.700^{+}
SDA (perc)	-0.029***	-0.578*	-0.247*	-0.349***^{A}
	(0.004)	(0.315)	(0.132)	(0.127)
A-P First stage χ^2	–	6.698^{+}	9.600^{+}	7.769^{+}
SDA (pcf)	-0.605***	-15.028**	-8.714*	-11.583***
	(0.128)	(6.970)	(4.855)	(4.047)
A-P First stage χ^2	–	8.534^{+}	8.922^{+}	8.232^{+}
N		9489		
Tobit Regression				
	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.231***	-4.065***	-2.762***	-3.470***
	(0.035)	(0.783)	(0.910)	(0.606)
SDA (perc)	-0.039***	-0.972***	-0.463***	-0.650***
	(0.005)	(0.187)	(0.152)	(0.121)
SDA (pcf)	-1.312***	-24.264***	-16.022***	-20.383***
	(0.204)	(4.672)	(5.277)	(3.575)
N		10227		

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. The coefficients from the Tobit and IV-Tobit models are marginal effects for E(y|x, y>0). IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): χ^2> Stock/Yogo's (2005) critical value (25% maximal IV size).

Table B 6: Robustness Checks: Effect of SDA on Weeks Worked – Women

Linear Regression	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.097***	1.510	-0.205	0.409
	(0.028)	(1.778)	(0.992)	(0.857)
A-P First stage χ^2	–	1.852	2.915	2.367
SDA (perc)	-0.026***	0.374	-0.041	0.068
	(0.006)	(0.449)	(0.200)	(0.181)
A-P First stage χ^2	–	1.733	4.189	2.823
SDA (pcf)	-0.726***	11.123	-1.617	3.382
	(0.214)	(12.917)	(7.812)	(6.622)
A-P First stage χ^2	–	1.981	2.720	2.342
N	5262			
Tobit Regression	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.018	1.308**	0.632	0.973**
	(0.022)	(0.589)	(0.575)	(0.412)
SDA (perc)	0.002	0.337**	0.169	0.257**
	(0.005)	(0.152)	(0.154)	(0.108)
SDA (pcf)	-0.150	9.854**	4.787	7.357**
	(0.165)	(4.439)	(4.359)	(3.116)
N	14780			

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): $\chi^2 >$ Stock/Yogo's (2005) critical value (25% maximal IV size).

Table B 7: Robustness Checks: Effect of SDA on Hours Worked – Men

Linear Regression	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.092***	-3.517**	-0.744	-2.094**^{A}
	(0.031)	(1.670)	(1.053)	(0.922)
A-P First stage χ^2	–	7.117^{+}	7.478^{+}	6.816^{+}
SDA (perc)	-0.019***	-0.779*	-0.130	-0.367**
	(0.005)	(0.442)	(0.184)	(0.180)
A-P First stage χ^2	–	4.237^{+}	7.016^{+}	5.337^{+}
SDA (pcf)	-0.518***	-21.108**	-4.328	-12.233**^{A}
	(0.179)	(10.300)	(6.137)	(5.482)
A-P First stage χ^2	–	7.943^{+}	7.991^{+}	7.457^{+}
N		9288		
Tobit Regression	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.247***	-5.129***	-1.714*	-3.568***
	(0.038)	(0.961)	(1.010)	(0.690)
SDA (perc)	-0.033***	-1.227***	-0.287*	-0.631***
	(0.006)	(0.230)	(0.169)	(0.135)
SDA (pcf)	-1.417***	-30.617***	-9.941*	-20.870***
	(0.221)	(5.738)	(5.861)	(4.065)
N		10227		

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): $\chi^2 >$ Stock/Yogo's (2005) critical value (25% maximal IV size).

Table B 8: Robustness Checks: Effect of SDA on Hours Worked – Women

Linear Regression				
	OLS	IV		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.119***	-2.861	-1.214	-1.909
	(0.038)	(2.503)	(1.551)	(1.374)
A-P First stage χ^2	–	2.318	2.676	2.473
SDA (perc)	-0.035***	-0.763	-0.242	-0.388
	(0.009)	(0.691)	(0.295)	(0.284)
A-P First stage χ^2	–	1.898	4.056	2.862
SDA (pcf)	-0.893***	-21.281	-9.619	-14.914
	(0.293)	(18.379)	(12.393)	(10.674)
A-P First stage χ^2	–	2.431	2.470	2.434
N		5169		
Tobit Regression				
	Tobit	IV-Tobit		
	–	IV (1)	IV (2)	IV (1+2)
SDA (linear)	-0.024	0.592	0.451	0.521
	(0.019)	(0.508)	(0.491)	(0.355)
SDA (perc)	-0.001	0.153	0.121	0.137
	(0.005)	(0.131)	(0.132)	(0.093)
SDA (pcf)	-0.194	4.462	3.416	3.935
	(0.144)	(3.826)	(3.725)	(2.685)
N		14733		

Note: Each coefficient is obtained from a different regression. In Tobit and IV-Tobit results marginal effects are presented. Standard errors are clustered on individuals in the OLS and Tobit models and bootstrapped with 400 replications in the IV and IV-Tobit models. Standard errors in parentheses. *,** and *** denote significance level of 10%, 5% and 1%, respectively. IV (1) = homicide rates on state level, IV (2) = armed groups in neighbourhood. When two instruments are included, the Hansen's J test for overidentification is pursued. ^{A} indicates that the critical value $p > 0.1$, i.e. instruments are valid. $^{+}$ denotes strong instruments (not tested in Tobit models): $\chi^2 >$ Stock/Yogo's (2005) critical value (25% maximal IV size).