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Do the Psychological Impacts of War Cause Poverty? Evidence from Mozambique

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Abstract: This paper evaluates the extent to which war-related psychological distress causes poverty. The endogeneous nature of mental distress is addressed by using exposure to the civil war in Mozambique as an instrument. It is found that exposure to war has a significant and positive long-lasting impact on mental distress. Furthermore, the causal impact of war-related psychological distress on income and wealth is shown to be significant, negative, and non-negligible. One standard deviation increase in mental distress decreases income by half a standard deviation. These findings are robust to alternative specifications, including the use of an alternative database on the incidence of PTSD in Mozambique.

1. Introduction

Psychological distress robs people of their vitality, and ultimately, of their ability to enjoy life. In this paper, we argue that psychological distress is also an intangible handicap that prevents people from fully exploiting economic opportunities.

Mental distress is by no means a first-world phenomenon born of material excess and relative spiritual deprivation. In fact, neuropsychiatric disorders account for thirteen per cent of the global burden of disease, with middle- and low-income countries shouldering seventy per cent of this burden (World Health Organization, 2001). In spite of this, one third of the world's population lives in a country that allocates less than one per cent of its health budget to mental health. This means that globally, the average amount of money that is spent per person on mental health per year is around three U.S. dollars (World Health Organization, 2011). Clearly, mental health is regarded as accessory to other, more important, policy issues. This is particularly true in low-income countries where limited resources are less likely to be apportioned to seemingly non-essential policy areas (Mackenzie, 2014). Yet it is in these same areas where conflict is likely to occur (Miguel et al., 2004), and consequently, where people are most likely to suffer from war-related trauma. This paper proves that psychological

wellbeing should not be a second-order policy issue in countries with a history of conflict. It concludes that war-related psychological trauma is, in itself, an impediment to economic development. In effect, war-related psychological trauma not only keeps people from making the most of their lives, but also from making the most of economic opportunities.

A causal link between mental distress and poverty is established, using exposure to war as an instrument for the endogenous variable that is mental distress. Here, the use of a war-related instrument implies that the local average treatment effect is obtained. This means that the impact of mental distress on income is valid only for individuals whose levels of psychological wellbeing were affected by the war. Two measures of exposure to the civil war in Mozambique are used: whether or not the individual lives in an area previously controlled by the rebels, and whether or not the individual lives within six kilometres of a war zone.

This paper is divided into six further sections. Section two will start with a description of relevant literature. It will be shown that the literature tends to focus on either the economic and psychological impacts of war, or the causal impact of mental health on economic outcomes. There is a clear lack of work that joins these two distinct streams. Section three discusses the main two-stage least squares estimation strategy, focussing on the endogenous nature of mental distress. Research on the long-term impacts of war is used to argue in favour of the instruments' exclusionarity. Section four describes the four datasets and how they fit into the analysis. The main Afrobarometer dataset is used to show the OLS and IV impact of mental distress on income. The second dataset features psychiatric data and is used to highlight the OLS impact of severe mental disorders on income. The third dataset, which is used to analyse the reduced form impact of war on income, includes detailed individual-level economic information, as well as a binary measure of war exposure. The fourth and final dataset includes detailed psychiatric data and is used to calculate the IV impact of post-traumatic stress disorder (PTSD) on income. Section five describes and analyses the main estimation

results for the impact of mental distress on income. Firstly, the OLS impact of mental distress on income is shown. A natural experiment is exploited, whereby individuals within six kilometres of a war zone are compared with individuals between six and fifty kilometres of a war zone. This regression also highlights the reduced form impact of living in a war zone, which is shown to not have a statistically significant impact on income. This exercise is complemented with the estimation of the economic impact of severe mental disorders. Results imply that having a family member who suffers from psychosis reduces household income per adult by 14.8 per cent. Secondly, the reduced form impact of war is presented. Thus, losing a family member to war negatively impacts individuals' ability to provide for their children, but does not affect the likelihood that the individual owns a house. This latter point serves to highlight the non-persistent material impacts of war. Finally, the main IV estimation results are presented. In a first-stage analysis, it is shown that there is a positive and significant relationship between exposure to war and mental distress, even over a decade after the end of the war. The second stage results subsequently show that there is a clear and negative causal relationship between war-related mental distress and income. In particular, an increase in war-related mental distress by one standard deviation decreases income by 0.448 standard deviations. These results are non-negligible, as half a standard deviation of income represents between 15 and 30 U.S. dollars per month in a country whose monthly GDP per capita is roughly 50 U.S. dollars. Section six analyses the robustness of these findings. In first instance, the exogeneity and exclusionarity of the instrument is tested. This is done by considering the correlations between being in a war zone and having access to different types of infrastructure. It is shown that war zones have better access to electricity and water, but worse access to rail and sewage. Thus, it is argued that the latter two types of infrastructure are indeed necessary controls in the main IV regressions. It is also argued that the lower incidence of rail in war zones fits with historical reports that find that RENAMO systematically targeted this type of infrastructure. As a further robustness check, the

main IV regressions are replicated with two different specifications: using probit estimations, and excluding individuals in the largest cities. The second specification aims to control for possible migration between the end of the war and when the questionnaire was undertaken. Both these specifications yield results similar to those of the main estimation. As a third and final robustness test, IV estimates are obtained for the impact of post-traumatic stress disorder on wealth. It is found that an increase in PTSD by one standard deviation decreases the number of fields the individual owns by around seven. Section seven provides a conclusion of the results and presents some policy implications.

2. Literature review

The research question addressed by this paper represents the confluence of two distinct streams of literature: that of the impact of war, and that of the impact of mental health on income. Recent economic literature has focused on the micro-level impacts of war. This type of analysis requires detailed microeconomic data regarding war exposure, which is difficult to obtain. Nonetheless, there is some consensus in the literature that war actually stimulates individuals' political engagement, and therefore increases the quality of institutions. For instance, Bellows and Miguel (2009) conclude that victims of the Sierra Leone civil war were 2.6 percentage points more likely to vote, and 6.5 percentage points more likely to attend community meetings. Similarly, Blattman (2009) finds that former child-soldiers in Uganda are more likely to vote than their peers. Other work has focused on the psychological impacts of war. Cesur et al. (2013) exploit an exogenous variation in the deployment of U.S. troops to find that soldiers who witnessed civilian deaths were more likely to suffer from post-traumatic stress disorder upon returning home. In the same vein, Miguel et al. (2008) establish that football players from countries that endured brutal civil conflict were more likely to behave violently during matches. With respect to research that focuses on the impact of mental health on economic outcomes, most studies acknowledge the endogenous

nature of mental health. There is a large body of literature that overcomes this by using instrumental variables. For instance, Frijters et al. (2014) use the death of a friend as an instrument for depression. They find that a deterioration of mental health by one standard deviation decreases the probability of being employed by 30 percentage points. Other studies, such as Chatterji et al. (2007) and Ettner (1997) use personal characteristics as instruments (such as incidence of early psychiatric disorders, religiousness, and whether or not parents had psychiatric problems). Similar results are obtained. Banerjee et al. (2013) use a structural equation model to conclude that psychiatric problems have an adverse impact on labour market outcomes. In a related piece, Noonan and Cornan (2014) find that families in which the mother experiences post-natal depression are more likely to experience food insecurity. Here, the baby's health is used as an instrument for post-natal depression. Despite the existence of studies regarding both the consequences of war as well as the causal impact of mental health, there is a clear absence of work linking these two avenues of research. Accordingly, this paper hopes to fill the gap in the literature concerning the causal impact of war-related psychological scarring on economic outcomes.

2. Estimation strategy

This paper is primarily interested in understanding the extent to which war-related psychological scarring affects economic outcomes. In this case, as with many important questions, the direction of causality is paramount – does war-induced psychological distress directly *cause* worse economic outcomes? This matter would be fairly straightforward were it not for the issue of reverse causality. While psychological distress may affect economic outcomes, economic outcomes undoubtedly affect psychological distress. Furthermore, there are unobserved characteristics that are simultaneously related with economic outcomes as well as psychological distress. For instance, individuals that lived in impoverished households may be more at risk to war-related mental health problems. In this sense, it can be held

that the independent variable of interest – mental distress – is endogenous to economic outcomes. Accordingly, because the error term is very likely correlated with the independent variable of interest, a simple OLS estimate of the impact of mental distress on economic outcomes would lead to biased results, and most certainly not isolate the direction of causality:

$$Income_i = \alpha + \beta Mental\ distress_i + \varepsilon_i$$

$$E(Mental\ distress, \varepsilon) \neq 0$$

The most convincing way to begin circumventing this issue, then, is to apply methods that exploit exogenous variation in mental distress. Accordingly, this paper applies the instrumental variable method using two-stage least squares. In this case, exposure to the 15-year-long civil war in Mozambique instruments for mental distress. The Mozambique civil war, which began in 1977 following the country's independence, pitted the incumbent government party, FRELIMO, against dissenting rebels, RENAMO. Thus, the main two-stage regression of this analysis is as follows:

$$Income_i = \alpha + \beta Mental\ distress_i + \varphi District\ fixed\ effects + \omega Controls_i + \varepsilon_i$$

$$Mental\ distress_i = \gamma + \theta Exposure\ to\ war_i + \varepsilon_i$$

One identifying assumption of this strategy is the exclusionary nature of the instrument. That is, it must be credibly held that exposure to the civil war does not directly affect income. Evidence in favour of this supposition is provided, as there is a twelve-year gap between when the war ended and when the main survey data was collected. This, in turn, implies that the direct economic impacts of war had subsided by the point at which this information was collected. There is a large body of evidence that supports the claim that the direct persistent economic impacts of war are minor. In their analysis of the long-run impact of bombing in Vietnam, Miguel and Roland (2011) use distance from the 17th parallel north latitude as an instrument for bombing intensity. They find that by 2002, regions that were heavily bombed were no different with respect to poverty rates, consumption levels, electricity infrastructure, literacy, and population density. Similar findings have been replicated for Japan (Davis and

Weinstein, 2002) and Germany (Brakman et al., 2004). These findings seem to apply to our context of analysis, as Mozambique experienced an above-average growth of 3.9 per cent in the decade following the civil war[1].

Thus, two different war-related instruments are used. The first instrument represents whether or not an individual lives within six kilometres of a war zone. Here, the term "war zone" is taken to mean any location where a large number of war-related casualties occurred. The second instrument refers to whether or not an individual lives in an area previously controlled by the rebel forces (RENAMO). The logic behind this instrument is that these areas were less exposed to the war crimes that RENAMO perpetuated. This is because the rebels typically engaged in psychological warfare (for instance, through mutilations and sexual assault) in areas controlled by their adversaries, but refrained from doing so in their own areas. In fact, historical accounts suggest that rebel soldiers faced strict penalties for violent crimes within their areas of control (Africa Watch, 1996).

It is worth noting that because the IV method is used, findings should be interpreted as the local average treatment effect. This means that the estimation results are valid only for individuals whose level of mental distress was affected by the war. This particular treatment effect is at the heart of this paper's research question.

3. Data

This paper uses four different cross-sectional datasets in its analysis. The main Afrobarometer dataset is initially used to highlight the OLS impact of mental distress on income. This analysis is complemented by a psychiatric dataset concerning the incidence of severe mental disorders in Mozambique. At a subsequent stage, data collected by the University of Oxford is used to highlight the reduced form impact of exposure to war on economic outcomes. Then, the aforementioned Afrobarometer

[1] Source: UN statistics
[2] A special thank you to Tara McIndoe Calder for geocoding the war centres and sharing them.
[3] See appendix 1.
[4] Source: World Bank statistics.

dataset is again used for the main IV analysis. Finally, a detailed psychiatric dataset is shows the IV impact of PTSD on wealth.

The main dataset features survey information collected by Afrobarometer in 2004, for 1352 individuals in 81 districts across Mozambique. This dataset is used to establish the OLS and IV impact of mental distress on income. While the entire sample is used in some specifications as a baseline, the main analysis of this paper will focus on a sub-sample of the provinces most affected by the war: Gaza, Manica, Sofala, and Zambezia. A 1982 Situation Report by the South African government records that there were a total of 75 RENAMO attacks until that point, with the majority being in the aforementioned provinces: 24 in Gaza, seventeen in Manica, fourteen in Sofala, and seven in Zambezia. Gaza was especially affected by conflict in part because its predominantly Shangaan ethnic composition rivalled RENAMO's Shona ethnic base. In this instance, it is believed that areas that were less affected by the war are very different to those that were, so that using individuals in all regions as a control group would risk biasing the results. Furthermore, while Afrobarometer traditionally focuses on the political views of the populations of several African countries, it also includes one variable regarding the individual's level of "mental distress". This variable captures the frequency with which the individual felt worried or anxious in the month preceding the questionnaire, and is therefore ordinal. For ease of interpretation, the variable has been normalised. While "mental distress" does not provide detailed information for psychiatric standards, it does capture the basic symptoms of a range of mental health problems. Its all-encompassing nature is an advantage, as this paper is interested in general psychological distress rather than specific psychiatric illnesses. Moreover, individuals' exposure to war was added to the original dataset with two historical data: geographic coordinates of war centres (Batista et al., 2014)[2] and a map regarding the location of RENAMO-controlled zones[3]. More specifically, the coordinates of the war zones were used in combination with the coordinates of

[2] A special thank you to Tara McIndoe Calder for geocoding the war centres and sharing them.
[3] See appendix 1.

individuals' locations to determine whether or not the individual lives within six kilometres of a war centre. The RENAMO map was used to determine whether or not the individual lives in an area previously controlled by the rebels. The main dependent variable of interest – monthly income - is an ordinal variable, whereby each band represents roughly 30 to 60 U.S. dollars per month. To put this into perspective, Mozambique's monthly GDP per capita for 2013 was 49 U.S. dollars[4]. Again, for ease of interpretation, this variable has been normalised.

The second dataset includes psychiatric information that was collected by Patel et al. in 2003 (see appendixes 2 and 3). It serves to further highlight the OLS impact of mental distress on income, focusing on the specific impact of severe mental illness. The dataset features household-level data for a total of 2379 observations in the city of Maputo and rural town of Cuamba. A binary variable captures whether or not the household has a member who suffers from psychosis. It is worth noting that individuals who suffer from psychosis on a recurring basis typically have severe mental disorders such as Bipolar I or Schizophrenia. The dataset also includes a measure of income that has been adapted to reflect the household's income per adult. There is also a binary variable that reflects whether or not the household faced financial hardship.

The third dataset (see appendixes 4 and 5) features individual-level survey data that was collected by the University of Oxford in 2009. This information serves to highlight the reduced form impact of war on economic outcomes. The dataset includes a binary measure of whether the individual lost a family member to the civil war.

The fourth dataset (see table 6) features unique psychiatric survey data collected by Igreja et al. (1997) in the particularly war-struck region of Gorongosa. This dataset is used to establish IV estimates for the impact of PTSD on wealth. In this case, exposure to war trauma is measured by the 40-question "yes" and "no" Harvard Trauma Questionnaire. The final score captures the number of "yes" answers. The measure of

[4] Source: World Bank statistics.

PTSD is based on the outcomes of the 22-question Self-Report Inventory for PTSD (SRIP). Each question warrants an ordinal answer that describes the frequency with which the individual felt certain symptoms of PTSD. Accordingly, the PTSD score that is used is a sum of these answers (with higher numbers representing a higher frequency of PTSD symptoms). All the aforementioned variables have been normalised for ease of interpretation. Furthermore, the number of fields an individual owns serves as a proxy for wealth.

4. Results

The core of the results will look at the impact of mental distress on income, using exposure to war as an IV. However, in order to arrive at this analysis, the OLS impact of mental distress on income will be presented. Similarly, the reduced form impact of war on income will also be shown.

Table 1 features the descriptive statistics for both the main Afrobarometer dataset. Information is provided for both the entire sample and the sub-sample of individuals in the most war-afflicted provinces. It is clear that both groups are somewhat different with respect to mental distress and economic outcomes. Individuals in affected provinces have slightly less income and education, and spend a smaller proportion of their time working for a wage. They also spend a higher proportion of time employing other people and participating in community savings groups. These findings are in line with the hypothesis that individuals in affected provinces are different to those in the rest of the country. This confirms the idea that using individuals in the whole sample as a control group would lead to biased results.

TABLE 1 - DESCRIPTIVE STATISTICS

	Whole sample	Affected provinces
Mental distress	2.97	2.82
	(1.21)	(1.17)
Income	3.07	2.75
	(1.47)	(1.18)
Education	4.00	3.80
	(1.91)	(1.76)
Works for a wage	2.82	2.60
	(0.91)	(0.82)
Works as a trader	2.67	2.68
	(0.85)	(0.85)
Employs other people	2.31	2.39
	(0.69)	(0.70)
Participates in community savings group	2.35	2.43
	(0.81)	(0.90)
Grows own food	4.40	4.92
	(1.67)	(1.37)
Time spent doing household work per day	4.32	4.17
	(1.41)	(1.30)
Observations	1321	464

Note: Standard deviations are in parentheses. The statistics refer to survey data collected by Afrobarometer in 2004. “Mental distress” is an ordinal variable that captures the frequency with which the individual felt worried or anxious in the month preceding the questionnaire. “Income” is an ordinal variable where each income band represents between 30 and 60 U.S. dollars per month. “Education” represents the number of years the individual spent in education. All remaining variables are ordered, representing the frequency with which the individual engages in any given economic activity.. The first column refers to the entire sample of 1321 individuals across all provinces of Mozambique. The second column refers to a sub-sample of 464 individuals who live in the most war-afflicted provinces: Gaza, Manica, Sofala, and Zambezia.

Table 2 highlights the reduced form impact of mental distress on economic outcomes. In this case, a natural experiment is exploited. Here it is assumed that individuals within six kilometres of a war zone are similar to individuals between six and fifty kilometres of a war zone, except for their exogenous exposure to war. Thus, the impact of mental distress on income is calculated for individuals within war zones, using individuals just outside the war zones as a control group. An interaction between mental distress and being in a war zone serves to highlight these heterogenous effects. Here, the estimates refer to a baseline scenario where the individual does not suffer from mental distress at all. Thus, with controls, for individuals that were exposed to the war, the impact of an increase in mental distress by one band (that is, from not suffering from mental distress to suffering somewhat) decreases income by 0.690 standard deviations. This stands in contrast to the overall impact of mental distress, which seems to increase income. Moreover, living within six kilometres of a war zone

has no direct impact on income when individuals just outside the war zone are used as a control group. This finding is in line with prior research on the long-term effects of war.

TABLE 2 - OLS IMPACT OF MENTAL DISTRESS ON INCOME

	(1)	(2)	(3)	(4)	(5)	(6)
	Income					
Mental distress * Living within six km of war zone	-1.253**	-0.968**	-1.201*	-1.037*	-0.799*	-0.690*
	(0.573)	(0.436)	(0.620)	(0.511)	(0.590)	(0.511)
Mental distress	0.617*	0.433*	0.631*	0.539*	0.622*	0.530*
	(0.336)	(0.222)	(0.324)	(0.260)	(0.298)	(0.255)
Living within six km of war zone	0.294		0.073		0.210	
	(0.255)		(0.099)		(0.221)	
Education			0.270**	0.205**	0.159**	0.138**
			(0.083)	(0.090)	(0.087)	(0.089)
Occupation controls	No	No	Yes	Yes	Yes	Yes
Infrastructure controls	No	No	No	No	Yes	Yes
District fixed effects	No	Yes	No	Yes	No	Yes

Note: All regressions are OLS. Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). The regressions feature a sub-sample of 213 individuals from the most war-afflicted provinces (Gaza, Manica, Sofala, and Zambezia) who live within fifty kilometres of a war centre. The survey data was collected by Afrobarometer in 2004. All columns have "income", an ordered variable with nine income bands as the dependent variable. This variable has been normalized for ease of interpretation. Occupation controls include six ordinal variables. Infrastructure controls include "railway station in local area" (a binary variable) and "prevalence of roads in local area" (an ordinal variable). All regressions include standard errors clustered at the district level.

Appendixes 2 and 3 further highlight the OLS impact of mental distress on income. In this case, having a family member that suffers from psychosis reduces the household's income by 14.8 per cent. It is worth noting that this impact can be interpreted as causal, as psychosis is largely genetic, and therefore, plausibly exogenous (Ripke et al., 2011 and Sklar, 2011). However, the negative impact of this severe mental disorder is nullified once neighbourhood fixed effects are included. This suggests that families with ill individuals tend to self-select into neighbourhoods that are less economically vibrant.

The reduced form impact of war on income is established in appendixes 4 and 5. In this case, it is clear that having lost a family member to the war significantly increases the likelihood that the individual will not have enough money to provide for his or her children. However, it is also evident that having lost a family member to war has no

effect on whether the individual owns a house. This lends support to the hypothesis that the material impacts of war are not persistent.

Table 3 shows estimates for the first stage of two-stage least squares, using different combinations of the two instruments. It is clear that the psychological impacts of war, unlike material impacts, are long-lasting. Individuals who live within six kilometres of a war zone experience significantly more mental distress, while individuals who live in a previously RENAMO-controlled zone experience significantly less mental distress. Even though the results are equally significant for both the entire sample and the sub-sample, they become larger in magnitude when only the sub-sample is considered. As is clear in column (4), living in a war zone significantly increases mental distress by 0.618 standard deviations. Conversely, from column (5) it is evident that living in an area that was previously controlled by the rebels decreases mental distress by 0.467 standard deviations. This finding is consistent with the idea that individuals in RENAMO-controlled areas were less exposed to traumatic war crimes. Furthermore, the explanatory power of the instruments is large for all specifications, as the F-statistics exceed the relevant Stock and Yogo critical values. Using the two instruments in tandem allows us to statistically evaluate the exogeneity of the instruments using Sargan's overidentification test. In this case, it is reasonable to accept the null hypothesis that the instruments are exogenous[5]. Nonetheless, the highest F-statistic value of 379 is achieved when only the "lives within six kilometres of war zone" instrument is used, and for this reason, ensuing IV estimations will feature this instrument alone.

[5] The p-value is 0.1436.

TABLE 3 - FIRST STAGE OF IV ESTIMATION

	(1)	(2)	(3)	(4)	(5)	(6)
	Mental distress					
	Whole sample			Most affected provinces		
Lives within six km of war zone	0.416***		0.333***	0.618***		0.251
	(0.105)		(0.049)	(0.032)		(0.151)
Lives in RENAMO-controlled zone		-0.311***	-0.216***		-0.467***	-0.366**
		(0.095)	(0.046)		(0.118)	(0.149)
Education	0.061*	0.063*	0.062*	0.040	0.042	0.041
Occupation controls	Yes	Yes	Yes	Yes	Yes	Yes
Infrastructure controls	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	15.785	10.673	77.437	379.187	15.623	196.503

Note: All regressions represent the first stage of the two-stage least squares estimation. Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). The regressions feature survey data that were collected by Afrobarometer in 2004. Columns (1) to (3) include the entire sample of 1321 individuals from across Mozambique. Columns (4) to (6) feature a sub-sample of 464 individuals that live in the most war-afflicted provinces: Gaza, Manica, Sofala, and Zambezia. All columns have "mental distress" as the dependent variable. This variable is ordinal and captures the frequency with which the individual felt worried or anxious in the month preceeding the questionnaire. It has been normalized for ease of interpretation. The various columns feature the influence of the two different instruments on the endogenous variable. Columns (1) and (4) have "lives within six kilometers of war centre" as the main independent variable. This instrument is a binary variable that captures whether or not the individual lives within six kilometres of one of the 58 places where there were the most war-related casualties. Columns (2) and (5) have "lives in a RENAMO-controlled zone" as the main independent variable. This instrument is a binary variable that captures whether or not the individuals live in an area that was rebel-controlled during the civil war. Columns (3) and (6) have both instruments as the main independent variables. Occupation controls include six ordinal variables that capture the frequency with which the individual partakes in each economic activity: "works for wage", "works as a trader", "employs other people", "participates in community savings group", "grows own food", and "time spent doing household work per day". Infrastructure controls include "railway station in local area" (a binary variable) and "prevalence of sewage system" (an ordinal variable). All ordinal variables have been normalized for ease of interpretation. All regressions include standard errors clustered at the district level. The F-statistics refer to the first stage cluster-robust Kleinbergen-Paap Wald F-statistic.

Table 4 presents the IV and OLS estimations of the impact of mental distress on income. Columns (1) and (2) represent OLS estimates, and column (3) represents the IV estimates for the whole sample. It is interesting to note that the OLS estimates for the sub-sample show a positive (but insignificant) result, which may suggest that mental distress is correlated with characteristics that increase income. Column (4) shows the IV estimates for the sub-sample without any controls, while column (5) presents the same estimation with controls for education and occupation. An increase in mental distress by one standard deviation decreases income by 0.354 and 0.447 standard deviations respectively. Thus, the magnitude of the impact actually increases with the inclusion of occupation controls. This implies that people of certain occupations are more likely to suffer from the economic consequences of war-related trauma. Column (6) includes further controls for the prevalence of railway stations and

sewage system in the individual's local area. These variables, as will be shown in the robustness checks section, are important to ensure the exclusionarity of the instrument. Nonetheless, these infrastructure controls do not seem to have an appreciable impact on the results, which corroborates the exclusionary nature of the instrument. With all controls, an increase in mental distress by one standard deviation decreases income by 0.446 standard deviations. This is roughly equivalent to between 15 and 30 U.S. dollars per month in a country whose monthly GDP per capita is around 50 U.S. dollars. This effect is larger in magnitude than the impact of an extra year of education, which only increases income by 0.129 standard deviations. As mentioned, given that these results are two-stage least squares estimates, they represent the impact of mental distress on income for people whose mental health was affected by the war.

TABLE 4 - IMPACT OF MENTAL DISTRESS ON INCOME

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS		IV			
	Whole sample	Most affected provinces	Whole sample	Most affected provinces		
Mental distress	-0.020	0.102	0.101	-0.354***	-0.447***	-0.446***
	(0.034)	(0.063)	(0.419)	(0.000)	(0.053)	(0.053)
Education	0.110***	0.109***	0.104***		0.130***	0.129***
	(0.022)	(0.038)	(0.036)		(0.037)	(0.037)
Works for a wage	0.122***	0.086	0.123***		0.118	0.122*
	(0.028)	(0.073)	(0.028)		(0.072)	(0.073)
Works as a trader	0.003	0.005	0.002		0.024	0.025
	(0.022)	(0.042)	(0.022)		(0.049)	(0.048)
Employs other people	-0.026	0.049	-0.025		-0.010	-0.009
	(0.034)	(0.044)	(0.034)		(0.075)	(0.071)
Participates in community savings group	-0.000	0.000	-0.014		0.032	0.029
	(0.038)	(0.053)	(0.060)		(0.067)	(0.066)
Grows own food	-0.110***	-0.135**	-0.115***		-0.167*	-0.175**
	(0.036)	(0.062)	(0.060)		(0.086)	(0.086)
Time spent doing household work per day	0.000	0.007	-0.005		0.066	0.063
	(0.033)	(0.048)	(0.034)		(0.049)	(0.048)
Railway station in local area	0.029	0.013	0.028			0.048
	(0.053)	(0.058)	(0.049)			(0.082)
Prevalence of sewage system in local area	-0.052	-0.155***	-0.050			-0.136
	(0.057)	(0.052)	(0.052)			(0.098)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). Columns (1) and (3) feature the entire Afrobarometer sample for Mozambique. Columns (2) and (4) to (6) feature a sub-sample of individuals from the most war-afflicted provinces. All columns have "income", an ordered as the dependent variable. For column (3) the independent variable of interest, "mental distress", is instrumented by two binary variables: whether or not the individual lives within six kilometres of a war centre, and whether or not the individual lives in an area that was previously rebel-controlled. For columns (4) to (6) it is instrumented by "lives within six kilometres of a war centre" variable. This "mental distress" variable is ordinal. The occupation variables are ordinal and represent the frequency with which the individual partakes in these economic activities. The "railway station in local area" variable is binary. The "prevalence of sewage system in local area" variable captures the frequency with which the individual is exposed to a functioning sewage system. All ordinal variables have been normalized for ease of interpretation. All regressions include standard errors clustered at the district level.

5. Robustness checks

In order for these results to be truly valid, however, it must be argued that the instrument is exogenous and exclusionary. That is, the war zones were randomly chosen, and did not have a lasting impact on infrastructure. One historical supposition that may call the exogeneity of the instrument into question is that RENAMO tended to attack areas that were along major roads (Robinson, 2006). However, as Table 5 shows, there is no statistically significant relationship between war zones and the incidence of a major road within the district. Furthermore, one of RENAMO's main tactics was to destroy government infrastructure. This was particularly true for railway infrastructure (Vines, 1995). If this is shown to be the case, then it is essential to control for prevalence of railways in the IV regressions. In this way, the exclusionarity of the instrument is preserved. As is shown in table 5, it is indeed the case that war zones have significantly fewer railway stations. Thus, the validity of the preceding IV regressions is conditional on the inclusion of this control. With respect to other types of infrastructure, war zones appear to have significantly better access to electricity and piped water. These findings are in line with the literature on the positive long-run impacts of war. However, war zones also have significantly less access to sewage systems, which highlights the need to include this type of infrastructure as a control in the IV regressions. However, as noted before, the inclusion of these infrastructure controls does not have an appreciable impact on the estimates, which suggests that the instrument is indeed exclusionary.

TABLE 5 - PREVALENCE OF INFRASTRUCTURE IN WAR ZONES

	War zone
Road	0.088
	(0.102)
Electricity grid	0.165***
	(0.015)
Piped water	0.045*
	(0.025)
Railway station	-0.063***
	(0.018)
Sewage system	-0.186***
	(0.028)

Note: Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). The "road" variable is binary and represents whether or not a major road passes through the district, and was constructed using a roads map made by the African Development Bank. All remaining independent variables are ordinal and represent the frequency with which the individual encounters a given type of infrastructure in his or her local area. These variables have been normalized for ease of interpretation. Furthermore, these regressions use the Afrobarometer 2004 dataset for the sub-sample of individuals in the most war-affected provinces: Gaza, Manica, Sofala, and Zambezia.

Table 6 presents robustness checks for the main IV estimation. The first three columns represent probit IV estimations that take into account the fact that the dependent variable is ordinal. Results for this specification are also significant at the five per cent level, with slightly smaller, but equally negative, coefficients. Columns (4) to (6) exclude individuals in the largest cities (Chimoio, Quelimane, and Xai-Xai). The idea behind this check is to somehow control for the fact that individuals may not necessarily live in the same place as during the war years. If this were the case, then the mental health outcomes for a given war zone would instead represent the mental health of recent immigrants. For this reason, individuals in the largest cities are excluded, as it is more likely that they are post-war immigrants. Nevertheless, the results are robust to this specification.

TABLE 6 - ROBUSTNESS CHECKS

	(1)	(2)	(3)	(4)	(5)	(6)
	Income					
	Ordered probit			Excluding individuals in biggest cities		
Mental distress	-0.446***	-0.589***	-0.588***	-0.354***	-0.452***	-0.449***
	(0.052)	(0.079)	(0.078)	(0.000)	(0.050)	(0.050)
Education	0.129***	0.179***	0.178***		0.126***	0.124***
	(0.037)	(0.049)	(0.049)		(0.046)	(0.046)
Occupation controls	No	Yes	Yes	No	Yes	Yes
Infrastructure controls	No	No	Yes	No	No	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	464	464	464	369	369	369

Note: Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). The regressions feature a sub-sample of 464 individuals from the most war-afflicted provinces: Gaza, Manica, Sofala, and Zambezia. The survey data was collected by Afrobarometer in 2004. Columns (1) to (3) represent ordered probit IV estimates. Columns (4) to (6) are IV estimates for a sub-sample of inviduals who do not live in the cities of Chimoio, Quelimane, and Xai-Xai. All columns have "income", an ordered variable with nine income bands (2 being the lowest and 10 the highest), as the dependent variable. The independent variable of interest, "mental distress", is instrumented by a binary variable that represents whether or not the individual lives within six kilometres of a war centre. This variable is ordinal, with 2 representing the least mental distress and 6 representing the most. Occupation controls include six ordinal variables that capture the frequency with which the individual partakes in each economic activity: "works for wage", "works as a trader", "employs other people", "participates in community savings group", "grows own food", and "time spent doing household work per day". Infrastructure controls include "railway station in local area" (a binary variable) and "prevalence of roads in local area" (an ordinal variable). All ordinal variables have been normalized for ease of interpretation. All regressions include standard errors clustered at the district level.

Table 7 highlights the impact of a more specific measure of mental distress – degree of PTSD[6]. In the first stage of the two-stage least squares estimation, both overall PTSD and specific symptoms seem to be significantly correlated with exposure to war trauma. From the F-statistics it is also reasonable to conclude that the instrument is non-weak. Without control variables, PTSD and its symptoms have an unequivocal negative impact on wealth. More specifically, an increase in PTSD by one standard deviation decreases the number of fields owned by 7.507. Similarly, the increase of the frequency of bad memories by one standard deviation is associated with a decline in ownership of 8.536 fields. An increase in the frequency of the feeling that the past is repeating itself by one standard deviation decreases the number of fields owned by 7.685. The nullification of these results upon the inclusion of controls may suggest that particular types of people are particularly vulnerable to PTSD and its economic impacts.

[6] For descriptive statistics see appendix 6.

TABLE 7 - IMPACT OF POST-TRAUMATIC STRESS DISORDER ON WEALTH

	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(10)	(11)
	PTSD	Bad memories	Recurring past	Number of fields owned						
				OLS	IV					
PTSD				-0.020*	-7.507***	0.036				
				(0.011)	(2.488)	(0.165)				
Bad Memories							-8.536***	0.040		
							(3.142)	(0.184)		
Recurring past									-7.685***	0.035
									(2.619)	(0.161)
War trauma	0.177***	0.155***	0.173***							
	(0.050)	(0.050)	(0.050)							
Age						-0.003*		-0.004*		-0.004*
						(0.002)		(0.002)		(0.002)
Gender						-0.143		-0.138*		-0.137*
						(0.097)		(0.077)		(0.072)
Number of family members						0.009*		0.009*		0.009*
						(0.006)		(0.006)		(0.005)
Location controls	No	No	No	No	No	Yes	No	Yes	No	Yes
Family type controls	No	No	No	No	No	Yes	No	Yes	No	Yes
Profession controls	No	No	No	No	No	Yes	No	Yes	No	Yes
Civil status controls	No	No	No	No	No	Yes	No	Yes	No	Yes
F-statistic	12.425	9.507	11.793							

Note: Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). The regressions feature a sample of 384 individuals within the Gorongosa district of the Sofala province. Detailed psychiatric data was collected in 1997. The "PTSD" variable refers to a 22-question survey that captures the extent to which individuals are experiencing Post-Traumatic Stress Disorder. Each question of this survey warrants an ordinal answer that captures the extent to which the individual was exposed to different war events. The "war trauma" variable is based on the outcomes of the 40-question Harvard Trauma Questionnaire. This questionnaire entails strictly "yes" and "no" answers, so that the final score reflects the number of "yes" answers. Accordingly, the final score is simply the sum of these answers. The "bad memories" variable refers to a specific question of the PTSD questionnaire that captures the extent to which the individual is haunted by memories of bad past life events. The "recurring past" variable refers to a specific question of the PTSD questionnaire that captures the extent to which the individual re-lives traumatic events that happened in the past. These variables have been normalized for ease of interpretation. The "number of fields owned" variable represents the number of fields the individual owns and serves as a proxy for wealth. Here, fields are taken to mean “machambas”, which are a specific type and measure of field. Gender is a binary variable where 1 represents being female. Location controls include five dummies. Family type controls include four dummies. Profession controls include 30 dummies. Civil status controls include five dummies. The F-statistic for columns (1), (2), and (3) refer to the first stage Cragg-Donald Wald F statistic. Columns (1), (2), and (3) refer to the first stage results of the IV estimation, with "war trauma" as the main independent variable and "PTSD", "bad memories", and "recurring past" as the dependent variables. Columns (4) and (5) are OLS results for the impact of PTSD on number of fields. Columns (6) to (11) are IV.

6. Conclusion

This paper sought to establish the causal impact of war-related psychological scarring on economic outcomes. To this end, exposure to war was used as an instrument for psychological distress. The second stage of the estimation showed that an increase in mental distress by one standard deviation decreases income by roughly half a standard deviation. These are non-negligible numbers, as half a standard deviation represents between 15 and 30 U.S. dollars per month in a country whose monthly GDP per capita is around 50 U.S. dollars. These results were shown to be robust to a number of alternative specifications.

These findings imply that war-related psychological distress is persistent, even if the material impacts of war are not. More importantly, this psychological damage perpetuates poverty, even many years after conflict ends. Thus, just as psychological distress reduces quality of life, it also reduces the likelihood that individuals will seize the opportunities to improve their circumstances. Individuals' psychological suffering affects their ability to provide economically, which in turn affects adversely affects their psychological well-being. It can therefore be considered that psychological distress constitutes a very real poverty trap. However, in this instance, the source of the poverty trap does not lie in cemented institutions outside the control of the individual. Instead, the problem lies in the very way the individual perceives himself and his surroundings. While on a personal level the impact of negative psychological wellbeing is likely more significant and serious than the impact of national institutions, it is also easier to improve. As argued by Layard (2013), psychiatric and economic research shows that great improvements can be made with cost-effective medicine and talking therapies. In particular, it is estimated that the benefits of therapy, with respect to productivity gains, balance out its direct costs[7]. Within the context of Mozambique, based on the main results, investments in psychological well-being are cost efficient if they are below roughly 30 US dollars per person per month. This can easily be achieved, especially if group therapy is undertaken. A meta-analysis by Burlingame et al. (2003) shows that individuals exposed to group treatments were made better off than 72 per cent of control individuals. This paper highlights that investment in psychological wellbeing is an economic imperative that can greatly improve livelihoods at a relatively low cost. Psychological wellbeing is not a luxury; it is a necessity that left unaddressed perpetuates poverty.

[7] It is estimated that for the UK, a round of therapy costs around £750, while the benefits include about one month's worth of productivity.

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Appendix 1: RENAMO-controlled zones

Source: Vines (1995)

Appendix 2

APPENDIX 2 - DESCRIPTIVE STATISTICS

Psychosis	0.10
	(0.30)
Log income (per adult)	11.94
	(1.45)
Financial difficulty	0.50
	(0.50)
Education	6.05
	(3.66)
Age	33.46
	(13.43)
Observations	2739

Note: Standard deviations are in parentheses. The statistics refer to household-level psychiatric data that was collected in Maputo city and the rural town of Cuamba in 2003. This information is featured in table 9. The "psychosis" variable is binary and represents whether or not the household has a member that suffers from psychotic episodes. The "log income (per adult)" variable refers to the household income divided by the number of adults. The "financial difficulty" variable is binary, with one signifying that the household faced financial difficulty and zero signifying that it did not.

Appendix 3

APPENDIX 3 - IMPACT OF SEVERE MENTAL ILLNESS ON ECONOMIC OUTCOMES

	(1)	(2)	(3)	(4)	(5)	(6)
	Log income (per adult)			Financial hardship		
Psychosis	-0.456***	-0.148**	-0.059	0.066	0.036	-0.020
	(0.143)	(0.068)	(0.063)	(0.043)	(0.036)	(0.029)
Education		0.113***	0.075***		-0.026***	-0.023***
		(0.008)	(0.009)		(0.003)	(0.004)
Age		-0.003	-0.004		0.001	0.000
		(0.003)	(0.003)		(0.001)	(0.001)
Occupation controls	No	Yes	Yes	No	Yes	Yes
Ethnicity controls	No	Yes	Yes	No	Yes	Yes
Religion controls	No	Yes	Yes	No	Yes	Yes
Language controls	No	Yes	Yes	No	Yes	Yes
Marital status controls	No	Yes	Yes	No	Yes	Yes
Neighbourhood fixed effects	No	No	Yes	No	No	Yes

Note: Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). These regressions feature psychiatric data that was collected from 2739 households in the city of Maputo and rural town of Cuamba in 2003. Columns (1) to (3) have log income per adult in household as the dependent variable. Columns (4) to (6) have a binary measure of financial hardship as the dependent variable, with 0 being comfortable and 1 experiencing some hardship. The "psychosis" variable is binary, with 1 signifying that someone in the household suffers from psychotic episodes. Although this is not always the case, people that recurringly have psychotic episodes usually suffer from Schizophrenia or Bipolar I. Occupation controls include six dummies. Ethnicity controls include seven dummies. Religion controls include four dummies. Language controls include five dummies. Marital status controls include four dummies. All regressions include standard errors clustered at the neighbourhood level.

Appendix 4

APPENDIX 4 - DESCRIPTIVE STATISTICS

War-related death of a family member	0.58
	(0.49)
Age	37.59
	(13.58)
Shortage of money for food	0.97
	(1.15)
Shortage of money for education	1.47
	(1.25)
Owns house	0.084
	(0.36)
Owns land	0.6
	(0.48)
Owns radio	0.66
	(0.47)
Observations	3528

Note: Standard deviations are in parentheses. The statistics refer to individual-level survey data that was collected by the University of Oxford in 2009. This information is featured in table 8. The "war-related death of a family member" variable is binary and represents whether or not the individual lost a family member to civil war. The "shortage of money for food" variable is ordinal (0 to 3) and represents the frequency with which the individual was unable to afford food for his or her children. The "shortage of money for education" variable is ordinal (0 to 3) and represents the frequency with which the individual was unable to afford education for his or her children. The "owns house", "owns land", and "owns radio" variables are binary.

Appendix 5

APPENDIX 5 - REDUCED FORM IMPACT OF CIVIL WAR ON ECONOMIC OUTCOMES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Income	Shortage of money for food		Shortage of money for education		Owns house	
Lives within six km of a war zone	-0.275***						
	(0.044)						
War-related death of family member		0.223***	0.128	0.300***	0.213**	-0.000	-0.007
		(0.081)	(0.084)	(0.092)	(0.087)	(0.024)	(0.024)
Sex			0.067		0.061		0.022
			(0.088)		(0.097)		(0.027)
Age			-0.003		0.009**		-0.001
			(0.003)		(0.004)		(0.001)
Job status controls		No	Yes	No	Yes	No	Yes
Education controls		No	Yes	No	Yes	No	Yes
Marital status controls		No	Yes	No	Yes	No	Yes
Language controls		No	Yes	No	Yes	No	Yes
Religion controls		No	Yes	No	Yes	No	Yes
Ethnicity controls		No	Yes	No	Yes	No	Yes
Enumeration area fixed effects		Yes	Yes	Yes	Yes	Yes	Yes

Note: All regressions are OLS. Standard errors are in parentheses. Asterisks denote level of significance (*=0.1; **=0.05; ***=0.01). Column (1) features the reduced form impact of war on income, using a sub-sample of individuals in the most war-affected provinces of the 2004 Afrobarometer dataset. Columns (2) to (7) feature a sample of 3532 individual-level observations across Mozambique. This survey data was collected by University of Oxford in 2009. Column (1) has an ordinal measure of income as the dependent variable. The independent variable is a binary measure of whether the individual lives within six kilometres of a war zone. Control variables for education, occupation, local infrastructure, and district fixed effects are included. Columns (2) and (3) have a 0 to 3 ordered variable of frequency with which the individual faced money shortage to buy food for children as the dependent variable (with 3 being "often"). Columns (4) and (5) have a 0 to 3 ordered variable of frequency with which the individual faced money shortage to pay for children's education as the dependent variable (with 3 being "often"). Columns (6) and (7) have a binary variable of whether the individual owns a house as the dependent variable. The "war-related death of family member" variable is a binary and represents whether or not the individual lost a family member to the civil war. Job status controls include dummies for whether the person is employed, unemployed, or not in the labour force. Education controls include nine dummies for each level of education. Language controls include 17 dummies. Ethnicity controls include 15 dummies. Religion controls include five dummies. All regressions include standard errors clustered at the enumeration area level.

Appendix 6

APPENDIX 6 - DESCRIPTIVE STATISTICS

PTSD	37.94
	(22.72)
War trauma	42.65
	(8.20)
Number of fields	1.47
	(5.02)
Age	44.47
	(13.97)
Observations	384

Note: Standard deviations are in parentheses. The statistics refer to psychiatric survey data collected in 1997. The "PTSD" variable refers to a 22-question survey that captures the frequency with which individuals experience symptoms of Post-Traumatic Stress Disorder. The "war trauma" variable is based on the outcomes of the 40-question Harvard Trauma Questionnaire. This questionnaire entails strictly "yes" and "no" answers, so that the final score reflects the number of "yes" answers. Accordingly, the final score is simply the sum of these answers.