The impact of psychological trauma on wages in post-conflict Bosnia and Herzegovina

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ABSTRACT

In the last three decades, armed conflict has increasingly been fought among civilian populations, resulting in greater physical and mental tolls. Soldiers returning from combat with psychological trauma are now receiving medical and policy attention for reintegration into the workforce. However, there is little attention on the impacts and options available to civilians who may face similar problems achieving labor force success after exposure to war-related trauma. Using the Bosnia and Herzegovina Living Standards Measurement Survey for years 2001—2004, we study wage attainment for 7659 respondents in relation to a series of psychological trauma measures which correspond to those used in PTSD diagnosis. In standard OLS regression, all subcomponents of PTSD have a negative impact; however, once unobserved individual heterogeneity is taken into account, some of the individual elements of psychological trauma have positive impacts on wage attainment. This is one of the first studies to find evidence of Posttraumatic Growth using information beyond psychometric instruments. The impact of the PTSD condition itself is insignificant in both models, and we do not find evidence of selection bias. We determine that the traditional means of predicting wages in labor economics are relevant in a post-conflict environment.

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Introduction

In the aftermath of conflict, many studies have been conducted on how to repair capital, whether physical (Giovannetti, 2009; OECD, 2009), human (Collier, 2003; León, 2010), or social (Colletta & Cullen, 2002; Collier, 2002, pp. 19—41). Much of the work in human capital, however, has been focused on either the emigration or "brain drain" of the conflict area (Schierup, 1995; Straubhaar, 2000; Vuković, 2005) or the impacts on the educational system (Justino, 2011, pp. 1—17; Shemyakina, 2011), which affects the accumulation of human capital in the future. Existing human capital can also suffer damage and wear; however, the economic literature has put little attention on contemporaneous effects and re-establishment policies of these potential workers following civil conflict, especially in an international and non-migratory context. Fields such as medicine have studied the lingering psychological impacts of conflict to a great extent; a growing body of work discussing civilian post-traumatic stress disorder (PTSD) mirrors the necessary shift that battlefield medicine needs to take when war is no longer confined to formal battlefields (Mollica, 2000; Shapinsky, Rapport, Henderson, & Axelrod, 2005). However, the consequences of unnoticed or poorly measured damage in the productive capacities of the workforce itself may be dire for both the individual and the economy at large.

This study uses the World Bank Bosnia and Herzegovina (BiH) Living Standards Measurement Survey, which is a longitudinal dataset from 2001 through 2004, to determine the impacts of conflict-related mental trauma on wages for individuals in the Republic of Bosnia and Herzegovina and Republika Srpska. The information between was collected September and November of each year by State Agency for Statistics for BiH — BHAS, the RS Institute of Statistics-RSIS, and the FBiH Institute of Statistics-FIS, with support from Department for International Development of the British Government (DfID), United Nations Development Program (UNDP), the Japanese Government, and the World Bank. The survey uses questions which are analogous to the DSM-IV instrument for Post-Traumatic Stress Disorder diagnosis, allowing us to draw reasonable conclusions about the impact of such trauma on wage rates and labor force participation; further, each individual component of the PTSD criterion is also tested to see if the impacts on labor market outcomes can be traced to any aspects of PTSD. Using a standard

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Mincerian approach, we evaluate whether these mental health indicators have any effect on average log monthly wages after controlling for socioeconomic and job characteristics, using a standard ordinary least squares approach as well as a panel fixed effect model to control for individual heterogeneity. We find that the classification of a PTSD-like condition has no impact on wage earnings, but that the different psychological components which comprise diagnosis have differing, and often significant, impacts. We also find that the negative impacts attributed to psychological trauma may be due to other elements of individual heterogeneity, since the coefficients on some measures of trauma are positive and significant when such factors are controlled using fixed effects regressions.

Background

The conflict in Bosnia–Herzegovina

The conflict in Bosnia and Herzegovina between April 1992 and December of 1995 can be considered a prototype for modern conflict (Andreas, 2004; Carballo et al., 2004; Martin, 2007). Presaged by economic difficulties and political unrest, violence spread throughout the population since civilians were often the intentional targets (Chossudovsky, 1997; Jung, 2003). In addition to the physical toll, however, the Bosnian War involved the largest contingent of mental health professionals used in a conflict up to that point, primarily due to the war's omnipresence in the lives of citizens (Mooren, de Jong, Kleber, & Ruvic, 2003). Up to 1 million people experienced mental trauma directly attributable to a war-related incident, with many more suffering from war-related mental trauma (Kozariæ-Kovaèiæ, Kocijan-Hercigonja, & Jambrošiæ, 2002).

As the Bosnian governments with the international financial community began post-war economic reconstruction, many programs and initiatives were created to separately address the employment crisis (Bayliss, 2005 Aug; Demirgüc-Kunt, Klapper, & Panos, 2011; Hartarska & Nadolnyak, 2008) and the mental health crisis (Laurie & Burton, 2005; Mooren et al., 2003; Pevalin & Robson, 2007). Several initiatives targeting employment in specific sectors or privatization became popular (Tiongson & Yemtsov, 2008), and although the rates of labor force participation increased, overall employment rates decreased, particularly in the private sector. However, there is a general lack of literature on the effectiveness of policy interventions for PTSD in relation to regained economic prospects (McCrone, Knapp, & Cawkill, 2003).

Mental health following civil conflict

There have been several studies of mental health in post-war Bosnia, both in the aggregate sense and on subsets of the population. Powell, Butollo, and Hagl (2010) compare the mental health outcomes of women whose husbands are missing versus those with confirmed spousal death. Siwiec (2011) finds that Bosnian refugees that immigrate to the U.S. did not have higher levels of depression, but Craig, Sossou, Schnak, and Essex (2008) found in their study of 126 Bosnian refugees in the U.S. that 66% of them displayed symptoms of PTSD between 6 and 12 years after displacement. Rosner, Powell, and Butello's (2003) study of Sarejevo survivors finds significant levels of PTSD (18.6%) in the control group of random residents, compared to the 32.7% and 38.6% in medical and psychiatric treatment plans, respectively. Witnessing violence was found to increase the prevalence of psychological disorders such as depression and anxiety in displaced Bosnian youth (Angel, Hjern, & Ingleby, 2001; Sujoldzic, Perternel, Kulenovic, & Terzic, 2006). Notably, however, Slodnjak, Kos, and Yule (2002) found that youths with more symptoms of PTSD performed better academically than comparable students.

This unanticipated result is an example of a new empirical finding called Posttraumatic Growth (PTG), which is part of a larger scope of research that explores positive personal growth following adversity (for an excellent summaries of the literature, see Linley & Joseph, 2004; Zoellner & Maercker, 2006, and Meyerson, Grant, Carter, & Kilmer, 2011 for the literature on PTG in children, specifically). The underlying theory of PTG is that experiencing trauma causes damage to pre-trauma beliefs and structures, which then causes the individual to spend a great deal of time in self-evaluation (Calhoun, Cann, Tedeschi, & McMillan, 2000; Tedeschi & Calhoun, 1996; Tedeschi, Park, & Calhoun, 1998); this process of evaluation and rebuilding causes grief and distress, but also adaptive growth of both the self and the new lifestyle (Janoff-Bulman, 2002; Joseph & Linley, 2006). The traumatized person is able to rely on the support and archetypes of existing social and religious structures during their self-rebuilding process, emphasizing the continued and important role of support structures (both personal and mental health professionals) in recovery from trauma (Calhoun & Tedeschi, 2006; Helgeson, Reynolds, & Tomich, 2006; Prati & Pietrantoni, 2009; Tedeschi & Calhoun, 1996). Most of the research in this area, however, has used psychometric properties such as self-evaluation such as the PTG Inventory (Tedeschi & Calhoun, 1996) or the Stress-Related Growth Scale (Park, Cohen, & Murch, 1996) and not external indicators of PTG such as school or work performance. This paper makes a contribution to the PTG literature by studying personal growth using an external outcome measure (wages) versus psychometric variables which are often difficult to precisely measure. The results, that those with higher levels of trauma experience faster wage growth, supplement the findings of Powell, Rosner, Butollo, Tedeschi, and Calhoun (2003), who found little evidence of PTG in Sarajevo survivors, but also experienced difficulty with the suitability of the American-made psychometric testing instrument.

Mental health and labor market outcomes

There is a significant subset of mental health work which observes the U.S. labor force outcomes for those suffering from PTSD and similar symptoms. Anderson and Mitchell (1992) found that military service increases the likelihood of many kinds of mental health and substance abuse, and these in turn negatively affect the employment decision and wage outcomes of U.S. veterans. Savoca and Rosenheck (2000), using cross-sectional information, found that U.S. veterans of the Vietnam War with PTSD diagnoses had both a lower likelihood of participating in the workforce and lower wages than those without PTSD. Smith, Schnurr, and Rosenheck (2005), also studying Vietnam veterans, found that those with PTSD symptoms were more likely to opt out, but that there were no wage impacts once occupation was controlled for. For Bosnia specifically, Mollica et al. (2001) found that refugees that emigrated were more traumatized, but had better mental health outcomes; this can be partially attributed to the access to an employment market and infrastructure that did not endure the conflict. Blight, Ekblad, Persson, and Ekberg (2006) interviewed Bosnian refugees in Sweden to assess the relationship between general mental health and unemployment, finding that unemployed men were generally unhappier (2006). Regardless of conflict location, the literature supports that the resumption of employment gives positive direction and purpose in addition to resources (Aycan & Berry, 1996).

Methodology

Data description

The primary data source is the World Bank Bosnia and Herzegovina (BiH) Living Standards Measurement Survey, administered

each year between 2001 and 2004 (Demirgüc-Kunt et al., 2011). The survey was conducted at the request of the government to provide guidance on formulating social policy appropriate for both the entity's post-conflict needs and their transition to a market economy (Laurie & Burton, 2005). The survey is therefore rich in both employment and health indicators, which we utilize in a panel format to provide insight into labor outcomes. Though the panel is short, it provides information to better control for unobserved heterogeneity compared to other similar studies of mental health impacts. Data was collected in accord with LSMS protocols developed to ensure consistency of data quality and the ethical treatment of interviewees; since the data is publicly available, we did not seek additional institutional review for the use of the survey responses. Further, the extensive documentation and monitoring of LSMS survey deployment provides additional safeguards for the confidentiality and any potential ill effects from the interview process ("Living Standard Measurement Survey Instruction on Data Collection and Survey Questionnaire Filling," 2001). Interviews were conducted directly with each member of the household older than ten years, which both broadens the sample and avoids measurement issues associated with proxying for other family members' information ("Living Standard Measurement Survey Instruction on Data Collection and Survey Questionnaire Filling," 2001). Despite this rigor, there is still inconsistency in some of the reporting, such as individuals indicating that they are unemployed but are still receiving a salary, or that they work as an unpaid member of a household business but still report income. Though these anomalies did not appear to occur in a systematic fashion, they no doubt add some extra noise to the measure of wages. However, errors in the measurement of the dependent variable primarily affect the standard errors of the regression, so these are not of primary concern.

Of greater note is the significant possibility of error in the assessment of mental health status; though the validity of such instruments has been extensively documented elsewhere, we cannot assume that no measurement error exists in trying to perfectly capture the trauma inflicted by war. Measurement error on the independent variables will generate an attenuation bias on the OLS, and to a greater degree the panel data models. However, given that individual heterogeneity appears to be correlated with mental status in the OLS models, the panel estimates are preferred.

One problem with the data is that mental health variables were not collected for the 2002 survey, the second year of the four-year period. Mental health status tends to follow a linear trend within the data over the four time periods. Therefore, we were able to compensate for the missing mental health data in 2002 by imputing the values using the average of measures from 2001 and 2003 on all 1942 observations. The imputation relies on the assumption that the change in mental health status was gradual and consistent over time, which is a defensible assumption given trends in the measures over the other three years. In similar fashion, information on education was missing for the year 2004. In this case, missing values for education level are imputed using the previous year of educational data since most respondents are not actively in school.

Measuring mental trauma

Attempting to classify and quantify mental trauma stemming from conflict is difficult as it is subject to measurement bias stemming from self-reporting, recollection, and interpersonal comparability. For example, many studies which focus on using past events to explain contemporary mental health have used various measures of trauma-causing events, which in the domain of

PTSD is often violent conflict. Physical event counts, such as the number of traumatic incidents or military records, are often used to avoid difficulties with recollection (Frueh et al., 2005); for example, Somasundaram and Sivayokan (1994) used the number of stressors experienced by a Sri Lankan sample to evaluate PTSD in a civilian population. Such objective measures often lose a significant portion of the individual heterogeneity which is critical in mental health work, so alternative subjective recollections of battlefield intensity, threat appraisal, or both are often used (Solomon, Mikulincer, & Benbenishty, 1989).

This study, however, uses current mental health to explain contemporary labor outcomes, which allows us to narrow the field of measurement instruments. The most common metric for the diagnosis of PTSD is that introduced by the American Psychiatric Association, which consist of a combination of 6 types of diagnostic criteria: a stressor event, intrusive recollection, three avoidant/numbing behaviors, two hyper-arousal behaviors, duration of symptoms, and the functional impact of the condition (American Psychiatric Association, 2000). PTSD scales can either be used as self-reporting or observational metrics (the correlation between the two is normally high, for example see Perconte & Wilson, 1994), though such diagnosis should be granted only by a qualified health professional.

We use responses from the LSMS to construct the PTSD scale. Criteria A is the experience of a fearful or horrified emotional reaction stemming from the event (American Psychiatric Association, 2000; Weathers & Keane, 2007); we assume that Criteria A is met since the war inflicted a significant level of trauma on the majority of inhabitants of Bosnia. The survey instrument of the LSMS provides all necessary diagnostic elements of Criteria B, C, and D (see Table 1 for the mapping of LSMS survey questions to DSM-IV criteria). Criterion E, which requires that the symptoms be present for more than a month, is assumed as well since we are working with annual data and mandating that symptoms be present for two years before considering them salient seems overly draconian and at odds with clinical practice and treatment. Criterion F concerns the impacts of the condition on the day-today functioning of the individual, and it is this Criterion that we are hoping to shed light on in the current study of wages.

Each of these questions addressing the six sub-criteria have associated categorical variables; survey responses are "Not at all" (1), "A little" (2), "Quite a bit" (3), and "Extremely often" (4). These sub-criteria are used to compile a binary variable representing a potential PTSD diagnosis. In order for an individual to be marked as potentially PTSD, a respondent needs to answer all six sub-criteria with levels of "quite a bit" or "extremely often." Limiting the analysis to a single binary classification (PTSD), however, overlooks many of the insights that this data can provide into which symptoms are indicative of greater workplace impacts. To make use of these sources of variation, we proceed with the analysis by including a variable defined as the sum of the six indicators (Trauma Sum), as well as each of the criteria, one at a time, in their own set of regressions to ascertain the impact of each trauma symptom on wage attainment. The distribution of mental trauma indicators over time is shown in Table 2.

According to Table 2, while most of the variation observed in wages and mental health indicators can be traced to differences across individuals (between variation, particularly for wages), there is substantial variation within individuals, enough to identify the impact on changes on mental health and wages through time. It possible that the source of the within variation on mental health can be traced back to improvements or relapse on mental health variables, while changes associated to wages are reflecting the wage trends/growth within individuals.

Table 1
DSM-IV PTSD diagnostic criteria and corresponding BiH survey responses.[a]

Criterion	Description	Variable	Study implementation
A: stressor	Exposure to a stressor event which included both threat or occurrence of death or grievous injury to self or others and an emotional response to this event which included fear, helplessness, and/or horror.		Bosnian War, taking place officially from April 1992–December 1995
B: intrusive recollection	Recurrent and intrusive recollections of the event, including images, thoughts, or perceptions.	War trauma	Q: During the last week did you constantly recall the most painful events you experienced during the war?
C: avoidant/numbing (3 required)	Sense of foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span)	Hopeless future	Q: During the last week did you feel hopeless in terms of the future?
	Feeling of detachment or estrangement from others	Melancholic	Q: During the last week did you feel melancholic?
	Markedly diminished interest or participation in significant activities	Such effort	Q: During the last week did you feel that everything was an effort?
D: hyper-arousal (2 required)	Difficulty falling or staying asleep	Problem sleeping	Q: During the last week did you have problems falling asleep or sleeping?
	Hyper-vigilance	Constant worry	Q: During the last week did you feel that you worried too much about different things?
E: duration	The duration of the symptoms has lasted for longer than one month		Assumed
F: functional impact	The condition significant difficulty or impediment in mental, social, or occupational circumstances.		Occupational impediment caused is the focus of this study.

All survey responses are "Not at all" (1), "A little" (2), "Quite a bit" (3), and "Extremely often" (4). Non-response to any of the questions excluded an observation from the sample.
[a] Questions from the "Living in Bosnia and Herzegovina Wave 4 Questionnaire and Show Cards 2004," State Agency for Statistics (BHAS), Republika Srpska Institute of Statistics (RSIS), and Federation of BiH Institute of Statistics (FIS), English version.

Dependent variable

The natural log of monthly wage received by employed workers is used as the dependent variable in this study. Due to significant number of people reporting zero as their monthly salary, we take the natural log of the reported wage plus one in order to avoid losing these observations. The denomination used in the analysis is the *marka*, denominated in the value of the year when the interview is conducted. The first half of the decade was marked by remarkably low consumer price inflation (below 0.55 for three of the four years), so wage level adjustment to inflation is unnecessary since we are examining a short four-year time period (Indexmundi, 2011). Though some individuals have multiple jobs at one time, only the information for the primary job was used.

Control variables

Past studies have found that much of the subjectivity in comparing psychological trauma due to interpersonal comparison can be attributed to socio-cultural elements (Colletta & Cullen, 2002; Collier, 2002, pp. 19–41); accordingly, we include a host of covariates offered by the LSMS. To construct the original Mincer equation, we include *education level*, but do not have individual experience information; rather, we include *age* and its quadratic as a proxy for labor force experience. Demographic information such as *marital status* and *gender* are included. We also include

Table 2
Mental health and wage variable characteristics ($N = 7659$).[a]

Variable	Year (Mean response)				Variation		
	2001	2002	2003	2004	Between	Within	Total
Log (wage + 1)	5.25	5.10	5.15	5.27	2.008	0.816	1.940
PTSD (all indicators > 2)	0.01	0.01	0.01	0.01	0.081	0.059	0.095
Trauma sum	9.30	10.07	10.71	10.60	2.812	1.732	3.169
War trauma	1.72	1.77	1.83	1.81	0.725	0.455	0.820
Hopeless future	1.58	1.75	1.87	1.89	0.708	0.465	0.803
Melancholy	1.44	1.57	1.69	1.69	0.594	0.404	0.682
Such effort	1.41	1.58	1.72	1.70	0.583	0.407	0.683
Problem sleeping	1.33	1.42	1.49	1.46	0.564	0.365	0.640
Constant worry	1.83	1.99	2.12	2.05	0.702	0.494	0.824

[a] Statistics based on pooled data.

geographical information in the form of the *entity* of residence (Bosnia and Herzegovina or Republika Srpska) and whether the individual was ever relocated due to the war (*displaced*). Dummies are included for *year* (with a base of 2001), for *sector* of employment (base of private/public sector), occupation (*job type*, base of large business ownership), and the existence of a second job; those who reported their employment standing as unemployed in this sample do not possess sector information. Summary statistics for these variables are included in Table 3.

Model specifications

A significant amount of literature exists following the labor and wage behavior of economies in transition (Adamchik & Bedi, 2000; Boeri & Terrell, 2002; Campos & Jolliffe, 2003; Orazem & Vodopivec, 1997; Pastore & Verashchagina, 2006; Spagat, 2006). Even beyond transitional economies, those torn by civil conflict often have a lack or absence of internal metrics and the existence of a thriving underground economy. Applying the standard Mincerian wage equation to a current- or post-conflict society, then, presents its difficulties. The standard Mincer equation relates the log of income to an individual's education, experience, and quadratic for experience, plus other socio-demographic characteristics (Hoti, 2011; Mincer, 1974); when families or businesses have been uprooted through civil unrest or conflict, both the recording and the relevance of such variables as experience in a job diminish. Accordingly, we utilize a modified Mincerian wage equation to estimate the impacts of psychological trauma on wages. Due to data limitations common to markets emerging from conflict, we substitute age and its quadratic as a proxy for labor force experience, and control for various demographic characteristics:

$$\log(wage_{it} + 1) = \alpha_0 + \beta^*X + \gamma^*PTSD_{it}, +\varepsilon_{it}$$

where X is a vector of demographic and job characteristics such as gender, age, education, whether they were ever displaced, and job sector and industry. PTSD is the diagnostic instrument used in this study; we also estimate models with the mental health indicators that comprise the PTSD diagnosis. The ε_{it} is an error term.

Initially, we estimate an ordinary least squares regression on the pooled data to obtain a first assessment of the impact of mental

Table 3
Sample characteristics ($N = 7659$).[a]

Variable	Study Sample			
	Mean	Std. dev.	Min	Max
Log (wage + 1)	5.1850	1.9428	0	8.666
PTSD (all indicators > 2)	0.0090	0.0945	0	1
Trauma sum	10.1658	3.1682	6	24
War trauma	1.7806	0.8202	1	4
Hopeless future	1.7716	0.8031	1	4
Melancholy	1.5926	0.6824	1	4
Such effort	1.6014	0.6829	1	4
Problem sleeping	1.4252	0.6398	1	4
Constant worry	1.9943	0.8236	1	4
Entity: Bosnia	0.4985	0.5000	0	1
Male	0.3455	0.4756	0	1
Civil status				
Never married	0.1978	0.3984	0	1
Married	0.7207	0.4487	0	1
Sep/Div/Widow	0.0815	0.2736	0	1
Ever displaced	0.3997	0.4899	0	1
Education level				
No diploma	0.0672	0.2505	0	1
Primary	0.1908	0.3929	0	1
Secondary	0.6140	0.4869	0	1
Junior college	0.0586	0.2349	0	1
Undergrad or higher	0.0693	0.2540	0	1
Age	40.6259	11.0007	15	70
Age^2	1771.4660	906.0598	225	4900
Year				
2001	0.2558	0.4363	0	1
2002	0.2536	0.4351	0	1
2003	0.2818	0.4499	0	1
2004	0.2089	0.4066	0	1
Has another job	0.0343	0.1821	0	1
Job type				
Owns large business	0.0508	0.2196	0	1
Owns small business	0.0725	0.2593	0	1
Entre./free profession	0.2439	0.4295	0	1
Private sector	0.3969	0.4893	0	1
Public sector	0.1816	0.3856	0	1
Unpaid support	0.0097	0.0978	0	1
International org	0.0187	0.1354	0	1
Farmer/Other	0.0260	0.1591	0	1
Sector				
Employed priv or pub	0.7690	0.4215	0	1
Self employed	0.1396	0.3466	0	1
Contract/Seasonal	0.0443	0.2057	0	1
Support (unpaid)	0.0471	0.2119	0	1

[a] Statistics based on pooled data.

health status when individual heterogeneity is not considered. In the pooled model we are not able to control for pre-existing mental health status (prior to 2001) and other unmeasured individual characteristics related to wages. To account for the bias that results from these omitted variables we utilize a model with individual fixed effects to control for individual heterogeneity, as well as time fixed-effects to control for economy-wide variation in wages. The panel model is specified as follows:

$$\log(wage_{it} + 1) = \alpha_0 + \beta^*X_{it} + \gamma^*PTSD_{it}, + time_t + \varepsilon_{it}$$

The ε_{it} is the fixed effect addressing unobservable individual heterogeneity, which we expect to be correlated with the explanatory variables (since current mental health status would be expected to have a relation to pre-war mental health status); the time fixed effect is denoted as $time_t$. In this specification, however, sex and displacement are not included in the vector of characteristics X, as they do not vary across time. Age is also excluded from the controls as it does not provides any variation once years fixed effects are being controlled. As in the OLS model, we also estimate additional models with the individual mental health indicators.

A Hausman test indicates that the fixed effects estimator is more appropriate than the random effects estimator.

Since there is the possibility that people with PTSD may be less (or more) likely to work, we also tested for sample selection bias into the workforce on all measures using the Heckman two-step method (Ermisch & Wright, 1993; Heckman, 1979). Using the receipt of pensions (non-labor income) as exclusionary variables, the inverse Mills ratio in the wage equations are highly insignificant across all specifications, indicating that there is no evidence of sample selection in the model. Other common sources of measurement bias in mental health literature are utilization bias (Frank & Gertler, 1991) or participation in the underground economy (Dell'Anno & Piirisild, 2004). Utilization bias is not expected to be an issue since the survey instrument was carried out in population samples, not from those seeking treatment from the mental health system. In the second case, while self-selection toward underground employment might exist, there is no reason to suspect that mental health is a factor that predisposes a potential worker into underground employment.

Results

OLS regression

As seen in Table 4, the standard OLS regression provides evidence that adverse mental health has a detrimental effect on wage attainment. Though the pseudo-diagnosis of PTSD is not significant, both the trauma summary and each psychological component have significant negative impacts. An additional level of severity (such as increasing from "sometimes" to "frequently") in having recollections of the war decreases log wage by 0.0688, while feelings of melancholy decrease log wage by 0.1453. Feelings that the future is hopeless had the largest impact of the psychological indicators, dropping log wages by 0.2087. It is not unreasonable to assume some level of endogeneity here, where a cycle of decreasing wages would spur further feelings of hopelessness. It is also possible that people with PTSD or other mental health traumas tend to work for low wage jobs, as they may have lost some of their human capital; such concerns provide an additional argument for utilizing individual fixed effects in further analysis.

Our findings on the more standard Mincerian elements are in line with the literature. Education shows consistent, positive, and increasing returns as the level of attainment increases, and this is consistent across all estimations. Age is positively related to wages, with a year increase bringing an increase in log wage of between 0.0444 and 0.0557 up to an age of approximately 37 years, then begins to decrease. As in Smith et al. (2005), we find the occupation categories to be significant in all cases. Those working anywhere but the private and public sectors tend to earn significantly less, especially in the support sector (which is often unpaid, and reports only the cash value of the in-kind payments received). Not surprisingly, owners of large firms have the largest wages, with small business owners (SBOs) being almost twice as bad off compared to large business owners as entrepreneurs, possibly due to the need to pay others wages. Working in the public sector has the second-lowest returns, with log wages being 2.0842 and 2.1601 lower than those owning a large business; this warrants further attention from policy-makers, especially in a post-war scenario where government jobs and spending are often a large component of recovery.

In demographics, we find that marriage is insignificant, but those who are separated, divorced, or widowed face a distinct wage disadvantage compared to single people. Though we find that living in Republika Srpska has an advantage when all other factors are held constant, we do not find a significant relationship regarding

Table 4
Impacts of mental trauma on wages, OLS estimation ($N = 7659$).[a,b,c]

DV = log(wage + 1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	PTSD	Trauma sum	War trauma	Hopeless future	Melancholy	Such effort	Problem sleeping	Constant worry
Mental trauma variable	−0.1703 (0.1833)	−0.0451*** (0.0063)	−0.0688*** (0.0224)	−0.2087*** (0.0245)	−0.1453*** (0.0289)	−0.1182*** (0.0280)	−0.1048*** (0.0304)	−0.1096*** (0.0219)
Entity	−0.5423*** (0.0399)	−0.5228*** (0.0393)	−0.5307*** (0.0396)	−0.5153*** (0.0391)	−0.5384*** (0.0395)	−0.5341*** (0.0396)	−0.5447*** (0.0397)	−0.5338*** (0.0396)
Male	0.0942* (0.0554)	0.09 (0.0548)	0.0891 (0.0552)	0.0725 (0.0541)	0.0808 (0.0552)	0.0976* (0.0552)	0.1018* (0.0553)	0.1025* (0.0552)
Married	0.0786 (0.0884)	0.1159 (0.0881)	0.0869 (0.0887)	0.0852 (0.0871)	0.1029 (0.0879)	0.0899 (0.0884)	0.0942 (0.0886)	0.0949 (0.0878)
Divorced/Sep/Widow	−0.2093*** (0.0395)	−0.1833*** (0.0390)	−0.2137*** (0.0394)	−0.2062*** (0.0388)	−0.1760*** (0.0401)	−0.2002*** (0.0394)	−0.1982*** (0.0394)	−0.1892*** (0.0393)
Displaced	0.0097 (0.0409)	0.0403 (0.0409)	0.0195 (0.0411)	0.0475 (0.0404)	0.0259 (0.0409)	0.0139 (0.0408)	0.0123 (0.0408)	0.0243 (0.0409)
Primary school	0.5009*** (0.1241)	0.4879*** (0.1225)	0.4990*** (0.1234)	0.4875*** (0.1226)	0.4897*** (0.1227)	0.4892*** (0.1237)	0.4946*** (0.1236)	0.5069*** (0.1241)
Secondary school	0.8436*** (0.1211)	0.8008*** (0.1194)	0.8359*** (0.1204)	0.7993*** (0.1196)	0.8166*** (0.1197)	0.8211*** (0.1205)	0.8276*** (0.1208)	0.8357*** (0.1209)
Junior college	1.2637*** (0.1481)	1.1900*** (0.1471)	1.2481*** (0.1475)	1.1860*** (0.1468)	1.2244*** (0.1472)	1.2276*** (0.1474)	1.2376*** (0.1485)	1.2432*** (0.1479)
Undergrad or higher	1.7451*** (0.1260)	1.6604*** (0.1245)	1.7283*** (0.1253)	1.6439*** (0.1247)	1.7039*** (0.1245)	1.7072*** (0.1254)	1.7180*** (0.1262)	1.7173*** (0.1254)
Age	0.0444*** (0.0136)	0.0557*** (0.0136)	0.0488*** (0.0136)	0.0547*** (0.0134)	0.0503*** (0.0135)	0.0475*** (0.0135)	0.0463*** (0.0136)	0.0500*** (0.0137)
Age^2	−0.0006*** (0.0002)	−0.0007*** (0.0002)	−0.0007*** (0.0002)	−0.0007*** (0.0002)	−0.0007*** (0.0002)	−0.0007*** (0.0002)	−0.0006*** (0.0002)	−0.0007*** (0.0002)
Another job	−0.6605*** (0.1346)	−0.6495*** (0.1333)	−0.6653*** (0.1342)	−0.6403*** (0.1326)	−0.6564*** (0.1340)	−0.6558*** (0.1346)	−0.6662*** (0.1348)	−0.6398*** (0.1333)
Job Type: SBO	−2.7891*** (0.1712)	−2.7590*** (0.1696)	−2.7812*** (0.1707)	−2.7455*** (0.1699)	−2.7790*** (0.1702)	−2.7776*** (0.1703)	−2.7850*** (0.1705)	−2.7805*** (0.1711)
Job Type: Entrep/free profession	−1.4045*** (0.1718)	−1.3874*** (0.1708)	−1.4087*** (0.1713)	−1.3486*** (0.1697)	−1.3966*** (0.1715)	−1.3948*** (0.1714)	−1.4063*** (0.1716)	−1.4042*** (0.1721)
Job Type: Priv sector	−1.6845*** (0.1697)	−1.6697*** (0.1688)	−1.6856*** (0.1693)	−1.6337*** (0.1677)	−1.6720*** (0.1694)	−1.6766*** (0.1693)	−1.6872*** (0.1694)	−1.6889*** (0.1700)
Job Type: Public sector	−2.1556*** (0.1785)	−2.1381*** (0.1771)	−2.1601*** (0.1781)	−2.0842*** (0.1760)	−2.1435*** (0.1779)	−2.1485*** (0.1779)	−2.1567*** (0.1782)	−2.1593*** (0.1785)
Job Type: Support	−1.5900*** (0.2961)	−1.5668*** (0.2916)	−1.5834*** (0.2944)	−1.5390*** (0.2931)	−1.5800*** (0.2926)	−1.5832*** (0.2942)	−1.5796*** (0.2943)	−1.6013*** (0.2959)
Job Type: INGO	−0.9681*** (0.1903)	−0.9230*** (0.1905)	−0.9576*** (0.1908)	−0.8841*** (0.1895)	−0.9507*** (0.1894)	−0.9523*** (0.1913)	−0.9700*** (0.1900)	−0.9402*** (0.1907)
Job Type: Farm/other	−1.9297*** (0.2172)	−1.9267*** (0.2176)	−1.9234*** (0.2171)	−1.9069*** (0.2171)	−1.9282*** (0.2176)	−1.9380*** (0.2169)	−1.9370*** (0.2177)	−1.9372*** (0.2176)
Sector: Entrepreneur	−1.7057*** (0.1532)	−1.7077*** (0.1526)	−1.7176*** (0.1529)	−1.6849*** (0.1520)	−1.7042*** (0.1529)	−1.6955*** (0.1533)	−1.7074*** (0.1530)	−1.7091*** (0.1534)
Sector: Contract/season	−0.4532*** (0.1034)	−0.4147*** (0.1025)	−0.4475*** (0.1031)	−0.4050*** (0.1031)	−0.4357*** (0.1029)	−0.4421*** (0.1033)	−0.4447*** (0.1028)	−0.4326*** (0.1027)
Sector: Support	−3.8910*** (0.1262)	−3.8692*** (0.1260)	−3.8879*** (0.1263)	−3.8585*** (0.1258)	−3.8826*** (0.1258)	−3.8795*** (0.1261)	−3.8848*** (0.1263)	−3.8857*** (0.1262)
2002.year	−0.2407*** (0.0657)	−0.2109*** (0.0657)	−0.2398*** (0.0657)	−0.2008*** (0.0655)	−0.2230*** (0.0657)	−0.2248*** (0.0657)	−0.2328*** (0.0657)	−0.2277*** (0.0660)
2003.year	−0.2010*** (0.0647)	−0.1406** (0.0651)	−0.1948*** (0.0647)	−0.1347** (0.0647)	−0.1650*** (0.0651)	−0.1673*** (0.0648)	−0.1848*** (0.0648)	−0.1723*** (0.0653)
2004.year	−0.0314 (0.0688)	0.0248 (0.0692)	−0.0257 (0.0688)	0.0401 (0.0689)	0.0052 (0.0690)	−0.0002 (0.0688)	−0.0183 (0.0686)	−0.01 (0.0694)
Constant	6.2472*** (0.3348)	6.3719*** (0.3337)	6.2728*** (0.3346)	6.3022*** (0.3321)	6.3109*** (0.3336)	6.3189*** (0.3342)	6.3235*** (0.3355)	6.2973*** (0.3348)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
[a] Statistics based on pooled data.
[b] Standard errors in parentheses.
[c] Base categories are Never Married (for civil status variables), No Diploma (for education level variables), 2001 (for year variables), Owning a Large Business (for job type variables), and Employed in the Private or Public Sector (for sector variables).

displacement; this is perhaps because only those who were displaced and resettled are part of the sample, whereas other studies in the literature where significant effects were found often surveyed Bosnians in other countries or in IDP camps. Those who were working multiple jobs tended to have lower pay, which is intuitive: since the survey asked for wages from the main job only, those who were working more than one job were probably doing so to compensate for low wages. We also found a significant dip in log wages associated with 2002 compared to 2001, which became less severe in 2003 and insignificant in 2004.

Fixed effects estimation

The OLS estimates generally conform to the literature; however, this study is missing several controls of individual heterogeneity. For example, pre-existing mental state has been shown to be important in several studies regarding war trauma, and the OLS approximation assumes information on pre-conflict workforce experience has no effect on current outcomes. We expect that past mental state would have an impact on current mental state. Therefore, ignoring these unobserved characteristics might generate a correlation between the error and mental health status, creating a bias on our estimations. To accommodate these shortcomings, we choose to estimate a fixed effects regression which will control for some of the unobserved heterogeneity, assuming they remain invariant across time. We also perform a random effects estimation in case our hypothesis that the unobserved individual effects are correlated with the independent variables is incorrect and perform a Hausman test to choose the appropriate model. For each mental health variable, the null hypothesis that there is no difference between the random and fixed effects is rejected with a chi-squared statistic with 19 degrees of freedom which is no smaller than 419.38. Therefore, the Hausman test strongly indicates that the fixed effects regression is more appropriate.

As seen in Table 5, there are significant changes once the unobservable heterogeneity is accounted for. Most importantly, we see that the sign on all PTSD components become positive, and that the estimations on war trauma, feelings of hopelessness, and the aggregate trauma measure become positive and significant when time-invariant individual heterogeneity is being controlled for; this suggests that the adverse effects seen in the OLS regression may be due to underlying or tertiary factors, while some of the psychological elements which comprise PTSD may have positive impacts on wage attainment. The largest impact is from increased remembrances of the conflict, which may be indicative of the self-rebuilding introspection which was discussed in the PTG literature; similarly, there is precedence to expect more severe cases of aggregate trauma to show stronger signs of positive impact. The sign change on considering the future to be hopeless may be counterintuitive on its face, but also may be entwined with an underlying degree of unobservable pessimism that is dropped in the fixed effect regression. Having a second job continues to be negatively related to wages, though the impact is smaller. We also do not see any significance attached to the demographic variables or traditional Mincer variables, though this is probably due to the very small number of people changing marital status, finishing a degree, or emigrating between entities.

Sensitivity

We conducted two sensitivity tests on our specifications for both the definition of PTSD and the linearity of the relationship between wages and the mental health variables.

First, PTSD is defined for the purpose of this study as the condition which exists when all self-reported psychological indicators have values greater than "quite a bit." Since this is an approximation

Table 5
Impacts of mental trauma on wages, fixed effects estimation (N = 7659).[a,b,c]

DV = log(wage + 1)	(1) PTSD	(2) Trauma sum	(3) War trauma	(4) Hopeless future	(5) Melancholy	(6) Such effort	(7) Problem sleeping	(8) Constant worry
Mental trauma variable	0.1295 (0.1932)	0.0132* (0.0069)	0.0485* (0.0251)	0.0460* (0.0250)	0.0265 (0.0289)	0.0303 (0.0292)	0.0126 (0.0315)	0.0263 (0.0234)
Another job	-0.2476*** (0.0858)	-0.2441*** (0.0858)	-0.2446*** (0.0857)	-0.2456*** (0.0857)	-0.2487*** (0.0857)	-0.2468*** (0.0858)	-0.2480*** (0.0858)	-0.2500*** (0.0857)
Job Type: SBO	-1.1216*** (0.1190)	-1.1221*** (0.1190)	-1.1213*** (0.1190)	-1.1243*** (0.1190)	-1.1208*** (0.1190)	-1.1224*** (0.1190)	-1.1215*** (0.1190)	-1.1225*** (0.1190)
Job Type: Priv sector	-0.4331*** (0.1373)	-0.4235*** (0.1374)	-0.4236*** (0.1374)	-0.4323*** (0.1373)	-0.4285*** (0.1374)	-0.4306*** (0.1373)	-0.4310*** (0.1373)	-0.4278*** (0.1374)
Job Type: Public sector	-0.7014*** (0.1492)	-0.6921*** (0.1492)	-0.6903*** (0.1492)	-0.7046*** (0.1491)	-0.6966*** (0.1493)	-0.6991*** (0.1492)	-0.6997*** (0.1492)	-0.6959*** (0.1492)
Job Type: Support	-0.6228*** (0.2188)	-0.6194*** (0.2187)	-0.6212*** (0.2187)	-0.6249*** (0.2188)	-0.6219*** (0.2188)	-0.6188*** (0.2188)	-0.6209*** (0.2188)	-0.6148*** (0.2189)
Job Type: Farm/other	-0.6174*** (0.1449)	-0.6049*** (0.1449)	-0.6100*** (0.1448)	-0.6073*** (0.1449)	-0.6108*** (0.1449)	-0.6120*** (0.1449)	-0.6139*** (0.1449)	-0.6115*** (0.1449)
Sector: Entrepreneur	-0.7852*** (0.1169)	-0.7817*** (0.1168)	-0.7801*** (0.1168)	-0.7861*** (0.1168)	-0.7819*** (0.1169)	-0.7866*** (0.1169)	-0.7839*** (0.1169)	-0.7810*** (0.1169)
Sector: Contract/Season	-0.2249** (0.1053)	-0.2282** (0.1053)	-0.2251** (0.1053)	-0.2286** (0.1053)	-0.2250** (0.1053)	-0.2278** (0.1053)	-0.2244** (0.1053)	-0.2271** (0.1053)
Sector: Support	-2.3906*** (0.1456)	-2.4037*** (0.1458)	-2.4027*** (0.1457)	-2.3996*** (0.1457)	-2.3925*** (0.1457)	-2.3943*** (0.1457)	-2.3911*** (0.1457)	-2.3952*** (0.1457)
2002.year	-0.1564** (0.0755)	-0.1670** (0.0757)	-0.1609** (0.0755)	-0.1669** (0.0757)	-0.1602** (0.0756)	-0.1600** (0.0756)	-0.1576** (0.0756)	-0.1607** (0.0756)
Constant	6.6164*** (1.1781)	6.4980*** (1.1792)	6.5265*** (1.1782)	6.5525*** (1.1777)	6.6008*** (1.1781)	6.6230*** (1.1771)	6.6395*** (1.1773)	6.5754*** (1.1787)

*p < 0.1, **p < 0.05, ***p < 0.01.
[a] Standard errors in parentheses.
[b] Base categories are 2001 (for year), Owning a Large Business (for job type), and Employed in the Private or Public Sector (for sector).
[c] Only significant results reported.

of a professional's trained opinion, we also include the results for when the classification of PTSD occurs when all symptoms are equal to or greater than "a little" and when they are equal to or greater than "extremely often." Results for the alternate definitions are seen in Table 6. There is little significant change except for the least restrictive version of PTSD in the OLS regression, where there is a significant adverse effect; this finding is tempered, however, with the knowledge that there is significant unobserved individual heterogeneity which impedes the reliability of OLS regression.

We also tested for a nonlinear relationship between the mental health variables and log wages by including a quadratic. There was no evidence of any nonlinearity in the mental health variables for any specification (OLS, fixed effects, random effects, and selection) except for a mildly significant quadratic term on *constant worry* during OLS estimation. This would imply that constant worry has negative impacts on log wage until a certain level of worry, then the negative impacts decrease. As with the prior sensitivity test, this finding is both consistent with PTG theory and tempered by the limits of OLS in this model.

Discussion

Widespread mental trauma following armed conflict is becoming a larger and more complex problem as civilians play growing roles (deliberately or inadvertently) in modern warfare. Such issues necessitate policy responses designed to both mend and encourage the individual while promote growth and recovery on a macroeconomic scale. This study provides evidence that mental health plays a significant (and occasionally positive) role in wage attainment, while providing direction in terms of which sectors need the most attention from an industry standpoint. Though a great deal of the policy emphasis following the conflict was on the creation of small businesses (Tiongson & Yemtsov, 2008), the question of whether the extremely low returns to that sector is due to the difficulties in implementation or the low returns of the policy warrant further attention.

This study joins the growing body of evidence that positive growth can occur following episodes of war-related trauma. This is not a substitute for treatment, but rather provides a more holistic view of the recovery process, offers additional tools in psychotherapy, and gives victims cause for optimism beyond the often counterproductive efforts to focus on the positive. As evidenced by the mixed results and sign reversal from the OLS to fixed effects model, there are still detrimental mental effects tied to other aspects of individual heterogeneity; however, PTG offers survivors and clinicians more options to facilitate recovery and economic reintegration. This study provides some evidence that not only does time decrease the frequency of mental preoccupation with conflict, but that individuals who have endured significant trauma on a PTSD-type scale can succeed in their reintegration with normal economic life.

The main strength of this study, different from others in the literature, is that it is able to control for individual heterogeneity, thus controlling for unobserved skill factors and the subject's health history. Using this methodology, we are able to obtain better estimates of psychological trauma on labor outcomes (wages) compared to the alternative OLS estimations. The results, however, are not without problems. The first drawback of the methodology is that it assumes that the individual heterogeneity is constant across time, but if factors like predisposition to PTSD, improvements on mental health, and decisions to work change across time in non-systematic ways, it might bias our estimations. The second drawback is the measurement errors of the dependent and independent variables. Although the paper uses the best available information from the survey, there is some measurement errors and missing information in important variables of the paper that could be biasing the results toward zero. This might increase the attenuation bias in the panel data estimations. The results across different specifications, however, indicate the results are consistent providing at least a lower bound of the true relationship between mental health and wages.

As a whole, the results indicate that, on average, people with PTSD or similar mental impacts from war-related trauma earn lower wages than their counterparts (OLS results). The panel results, however, indicates that when we control for the time invariant unobserved characteristics, workers with war-related mental trauma have experienced a faster growth of wages across time. While the latter results can be explained by post-traumatic growth, our results could be considered weak evidence on the success of policies of reintegration to the labor force. There is a note of caution, however, on the usual policy emphasis on entrepreneurism and small business ownership, as this sector and job type do not perform particularly well against other means of private, full-time employment. This also lends credence to other studies which have evidence of post-traumatic growth, many of which document the large roles that personal connections such as family and religion play in recovery (Calhoun & Tedeschi, 2006; Helgeson et al., 2006; Prati & Pietrantoni, 2009; Tedeschi & Calhoun, 1996). Employment initiatives for these individuals could therefore try to incorporate programs which build on these strong ties, in addition to providing family-based counseling such as the Family-to-Family program of the National Alliance on Mental Illness. Also of note, the possession of a job can be a positive influence on job success and mental well-being, so policies which attempt to enlist the worker in meaningful activity, even if it is not a permanent or full-time position, will likely have positive impact (Aycan & Berry, 1996); this is doubly so in light of our results, which suggest that recurrent thoughts of the war may serve as a vigorous appreciation for a "normal" working life. In all cases, policies to support the reintegration of civilians with war-related mental trauma should be encouraged to help a more rapid recovery of the labor market, which would help the recovery of the economy as a whole.

Table 6
Impacts of mental trauma on wages, sensitivity to PTSD severity.[a,b]

DV = log(wage + 1)	(1)	(2)	(3)
	OLS	Random effects	Fixed effects
PTSD (each sub-indicator > 1)	−0.1138**	−0.0262	0.0624
$\bar{z} = 0.1893$	(0.0483)	(0.0409)	(0.0492)
PTSD (each sub-indicator > 2)	−0.1703	−0.0444	0.1295
$\bar{z} = 0.0090$	(0.1833)	(0.1590)	(0.1932)
PTSD (each sub-indicator > 3)	−0.2764	−0.2035	−0.1746
$\bar{z} = 0.0004$	(0.2256)	(0.6571)	(0.6852)

[*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$.
[a] Standard errors in parentheses.
[b] 7659 observations with PTSD values of 1 (present) and 0 (not present).

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