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Abstract

In addition to the humanitarian suffering and huge immediate economic costs, the war in Ukraine will have long-term consequences, among which are losses in human capital that will impact aggregate productivity for many years. Exploiting a new stock measure of human capital combining the quality and quantity of education and adult skills, this paper suggests that losses in long-run aggregate productivity operating through the human capital channel could be at about 7% if the war lasts two years. These adverse effects come from school closure and the resulting decline in student learning outcomes and losses in workers' skills, which, without remedial policy action, could persist for decades.

JEL-Codes: E240, I190, I200, I250, I260, I280.

Keywords: human capital, productivity, educational achievement, student test score, adult test score, Ukraine.

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1. Introduction

The war in Ukraine is triggering a huge humanitarian crisis as many civilians, mainly women and children, have been fleeing abroad or moving within the country to escape the combat zones. The economy has taken a heavy blow, with GDP expected to decline by a third and the unemployment rate to increase by 20 percentage points to reach almost 30% in 2022 (National Bank of Ukraine, 2022; Ministry of Economy of Ukraine, 2023).

In addition, important long-term economic consequences are to be feared. Rebuilding physical infrastructures will take time and will be costly with reconstruction costs estimated between 200 and 500 billion euros, equivalent to 130% to 330% of Ukraine's pre-Covid GDP (Becker et al., 2022). It may take even longer and be more difficult to offset the consequences of the war on the physical and psychological health of the population and the losses in human capital.

Beyond the loss of life (of mostly prime-age males), there will be a further loss in the stock of human capital as a result of learning and teaching disruption due to school closures, the destruction of school building, displaced students and interruptions in electricity and internet services, and also from skill losses and reduced working abilities of the working age population. These losses, which will pile on to the ones already suffered from the COVID-19 pandemic, will have a subsequent negative effect on long-term productivity and economic growth.

This paper quantifies the losses in Ukraine's stock of human capital arising from lower educational outcomes (measured by student test scores) and adult skills and the long-term damage these losses inflict on productivity and output. The paper is structured as follows. Section 2 presents the calculation method. Section 3 discusses learning and skill losses in Ukraine. Section 4 presents the results. Finally, Section 5 concludes and provides some policy discussion.

2. The link between the quantity and quality of education, adult skills, and productivity

We estimate the adverse effects of the war in Ukraine on human capital and productivity based on the new stock measure of human capital developed in Égert et al. (2022), and the relationship linking this new measure to total factor productivity. This section reviews briefly these methodologies.

2.1. A stock measure of human capital incorporating the quantity and quality of education

We make use of a new measure of human capital, developed in Égert et al (2022), to calculate the negative war effects on human capital. This measure combines mean years of schooling, capturing the quantity of education, OECD data from the Programme for International Student Assessment (PISA), representing the quality of education, and the Programme for the International Assessment of Adult Competencies (PIAAC), reflecting adult skills. The stock measure of human capital is based on the idea that adult test scores (PIAAC) can be used to calculate a cohort weighted stock measure of human capital. However, because PIAAC covers a limited number of countries and has only one observation in time per country, it cannot be used to estimate cross-country time series regressions, which in turn would help link human capital with productivity.

To increase country and time coverage, adult test scores are regressed on mean years of schooling and student test scores. This is done by pooling all cohorts together where adult test scores of any given cohort are paired with mean years of schooling and PISA student test scores the very same cohort took

at the age of 15. Given that data on mean years of schooling and student test scores are available over time and for a larger set of countries, the regression is used to extrapolate adult test scores for countries and years for which PIAAC data are not readily available. For every OECD country, the stock of human capital is calculated as the cohort-weighted average of the estimated cohort-level adult test scores. This approach is appealing for two reasons. First, it extends the country and time coverage. Second, the relative weights on the quantity and quality of education are estimated rather than imposed. Table 1 reports the estimated elasticities borrowed from Égert et al. (2022) to calculate the stock measure of human capital.

Table 1. Regression results explaining adult test scores

			Coefficient of variation
Dependent variable: log(adult test scores)			1.4
α	Constant	3.732*** (0.25)	
β	log (Student test score), all cohorts (baseline effect)	0.278*** (0.04)	1.5
δ	log (Student test score), cohorts 50-59 (additional effect)	-0.009*** (0.00)	1.4
θ	log (Student test score), cohorts 60-65 (additional effect)	-0.015*** (0.00)	1.1
λ	log (Mean years of schooling (MYS))	0.083*** (0.01)	5.0
Adjusted R-squared		0.934	
Number of observations		220	
Number of countries		34	
Country fixed effects		YES	

Note: *** denotes statistical significance at the 1% level, based on heteroscedasticity-robust standard errors (in brackets). PIAAC adult test scores are the average of scores on literacy, numeracy and problem solving. Student test scores are PISA scores extended backwards with two vintages of World Bank data (Altinok et al., 2018) using chain linking the different series in order to obtain the longest time series possible. Student test scores denote the average scores for reading, maths and science. The mean years of schooling represent the average number of years of education of a specific age group by country. The coefficient of variation is equal to the standard deviation divided by the median multiplied by 100.
Source: Égert et al. (2022).

2.2. The link between human capital and total factor productivity

Once we have a time-series cross-country dataset on a stock measure of human capital, we can take it to a total factor productivity regression, which, among others, links human capital to productivity. The error correction model, reported in Table 2, provides us with the short-run and total long-run elasticities as well as the trajectory to the long-run equilibrium. The TFP regression is an updated version of the TFP regression reported in Égert (2016): it links TFP to product market regulation, trade and innovation intensity and human capital (Table 2). The TFP regression in Table 2 replaces the old measure of human capital, a variant version based on mean years of schooling adjusted for returns to education – which did not work very well – by the new stock measure described in Section 2.1. The long-run elasticity of human capital to productivity is relatively large (β=2.36), implying that a one percent increase (decrease) in

human capital goes in tandem with a 2.4 percent increase (fall) in long-term TFP. The TFP effect is computed for each cohort by considering their differentiated entry in the labour force and the estimated short-run and long- run elasticities. The total impact is then obtained via the population weighted average of each single cohort impact.

Table 2. Cross-country time series productivity regression

(OECD countries, 1987-2018)

Dependent variable: logged multi-factor productivity	Long run	Short run
Constant	-2.463	
ETCR indicator	-0.041**	-0.140**
Trade openness (adjusted for country size) divided by 100	0.114**	0.044**
Business expenditures on R&D (% of GDP)	0.080**	n.s.
log(Human capital stock)		
Population aged 16-39	2.359**	1.426*
Error correction term	-0.049**	
Adjusted R-squared	0.960	
Number of observations	524	
Number of countries	32	
Time fixed effects	NO	
Country fixed effects	YES	

Note: The human capital stock is based on log-log regression, with CFE.
Source: Égert et al. (2022).

3. The impact of wars on learning outcomes and adult skills

Evaluating the loss in Ukraine's human capital on the basis of the framework described in Section 2 requires information on the war's impact on learning outcomes and adult skills. These losses have not been measured and assessed at present. We rely on the existing literature that evaluates the impact of armed conflicts to provide a rough idea about these losses.

3.1. Learning outcomes following armed conflicts

Over and above the loss of life, the war in Ukraine is very likely to reduce the stock of human capital by lowering students' learning and increasing skill losses of adult workers. While we can currently only speculate about the extent of these losses, the extant literature on the impact of armed conflicts, however scarce it is, can give us an idea about the order of magnitude. The literature indeed provides persuasive evidence for strong negative effects of armed conflicts on student learning outcomes as proxied by student test scores. They are thought to come from the deterioration of school infrastructure, cuts in public education spending due to a shift towards military expenditures, lower educational investment by households in response to a recognition that their income and assets are fragile and the psychological impact on children (Bruck et al., 2019 and Ortiz-Correa, 2014). For instance, the Israeli-Palestinian conflict is estimated to generate a decrease in student test scores of up to one standard deviation, as compared to those of students not affected by the conflict. The effect stems from the deterioration of school infrastructures but also from the psychological impact (Bruck et al., 2019 and Jurges et al., 2022). Likewise, for Colombia, researchers identified a negative impact of up to 0.75 standard deviation of student test scores for children affected by the conflict. The effect is higher for

young children affected by the conflict at birth than for those affected by the conflict the year they were tested (Ortiz-Correa, 2014 and Rodriguez and Sanchez, 2010) (Table 1).

Table 3. Studies estimating the effect of war or local violence on student educational performance

Authors	Country	Type of conflict	Effect on student tests scores (measured as multiples of a standard deviation)
Bager et al, 2021	Denmark	Children whose parents suffered torture & war	-0.06 to -0.38
Bruck et al. , 2019	West Bank	Israeli–Palestinian conflict	-1.02
Jarillo et al., 2016	Mexico	Drug related violence	-0.04 to -0.02
Jurges et al 2020	West Bank	Israeli–Palestinian conflict	-0.08 to -0.35
Monteiro and Rocha, 2017	Brazil (Rio de Janeiro)	Drug battle	-0.05 to -0.12
Ortiz-Correa, 2014	Colombia	Armed conflict	-0.06 to -0.07
Rodriguez and Sanchez, 2010	Colombia	Armed conflict	-0.75
Sharkey, 2010	US (Chicago)	Local homicides	-0.50 to -0.66

Note: The effect on student tests scores reflects the length of exposure of children during the conflict but does not necessarily correspond to the entire duration of the conflict. It is unknown whether or not the effect is non-linear, so they cannot be standardized to one year for instance. For a detailed description of the studies, see table A1.
Source: Authors' compilation.

3.2. Adult skills in the aftermath of a war

Armed conflicts would certainly reduce human capital as a result of workers' skill losses during the war. Compared to learning losses, the erosion of adult skills will have a much more immediate impact on the stock of human capital of the labour force and productivity. Unfortunately, little empirical evidence exists on how wars reduce adult skills. However, skill losses suffered during prolonged periods of unemployment, which have for a long time been recognised in the theoretical literature, might provide some clues for such effects (Johnson and van Doorn, 1976; Pissarides, 1992).[2] Many empirical papers quantify such skill losses through the negative impact of unemployment spells on wages (e.g. Ortego-Marti, 2017), though a penalty on wages could also be explained by a stigma effect, changes to reservation wages, foregone experience or cohort effects (Edin and Gustavsson, 2008).

1. Some researchers looked at skill losses reflected in adult test scores. Direct evidence, relevant for our purposes, is provided in Edin and Gustavsson (2008), who showed empirically that adult literacy scores of Swedish workers were affected negatively and proportionately by the duration of

[2] It would be fair to note that long-term unemployment concerns mostly low-skill workers whereas the war affects a more heterogenous groups of workers and that there might be skill gains in certain areas such as managerial capacity or foreign language, though these latter gains would concentrate on sub-group of soldiers only. We can reasonably assume that on average, skills of an average soldier will be eroded over the course of the war.

unemployment spells.[3] More precisely, they show a drop of 20 points in adult tests scores for an unemployment spell of 42 months, which are equivalent to losses of 3.6% for 24 months.[4]

Beyond the erosion of skills, skill losses might come from composition effects as better-educated people, including mostly women (with children), but also men are more likely to leave the country, partly for good. The composition effect will also be at play if younger people are being killed in the conflict if younger cohorts are better skilled than older ones. A further complication is that skills required in a post-war economy might be different (Gorodnichenko et al., 2022). Finally, those fleeing the conflict might return to country with some new skills, foreign languages learned and new networks, offsetting some of the negative effects.

4. Evaluating the impact of the war on learning outcomes and adult skills in Ukraine

4.1. The parametrisation of the learning and skill losses

To quantify the war's effect, three elements need to be calibrated: i.) loss in time spent at school (quantity of education); ii.) loss in learning due to the war (quality of education), on top of the loss in learning time and iii.) loss in adult skills. The component effects are calibrated as follows:

- Mean years of schooling are reduced by two years.
- Losses in student learning are proxied by a loss of 0.8 of a standard deviation in student tests scores. This corresponds to the average of the three highest values reported in Table 1.[5]
- Adult skills for the entire labour force are assumed to be reduced by the equivalent of 0.15 of a standard deviation of PIAAC test scores, which implies that half of those in employment before the war will suffer serious skill losses. The unemployment rate had soared from 8% to 35% (Kyiv Independent, 2022) and possibly many more had withdrawn from the labour force, reflected in a sharp decline in the employment rate. This is a rough and approximative estimate of job losses.

4.2. The negative long-term effects are large

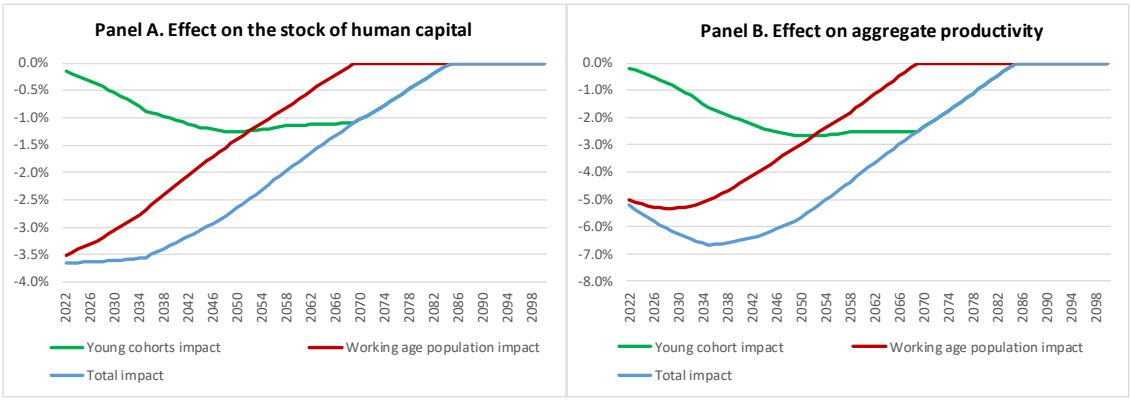
Results suggests that the overall macroeconomic effect is sizeable, dominated first by the immediate negative impact on the adult population, but then prolonged over time through the adverse effects on the student population, gradually entering the labour force in the future. Losses in human capital are estimated to peak between now and 2035 at around 3.6% (0.9% due to learning losses and 2.7% due to skill losses of workers) if the war lasts two years. The effect will last around 35 years and will diminish until the last cohort affected retires from the labour force at the age of 65 in 2085 (Figure 1, panel A). The impact of the war on productivity is assessed on the basis of the regressions linking human capital to TFP, co/ntrolling for other determinants. Accordingly, the losses in human capital are estimated to reduce the level of productivity by 6.7% at the peak in 2035 (Figure 1, panel B).

[3] Indirect evidence is provided in Dinerstein et al. (2020), who found in a natural experiment that unemployment spells of Greek teachers had a negative effect on the student test scores of the classes they teach.

[4] The loss of 20 points for 42 months correspond to a loss of 3.6% over two years: ((20/314)/42)*24 where 314 denotes the average adult test score.

[5] Our calculations assumes that learning losses have no direct linear relationship to the length of the war.

Figure 1. The adverse effect of a 2-year war on human capital and productivity in Ukraine



Source: Authors' calculations.

The estimated long-term impact of the war in Ukraine on productivity through the human capital channel are very likely to be lower bound estimates. The true impact might be much larger for three main reasons, but their exact quantification would involve a lot of speculation.

Firstly, the war effects reported in Table 1 are based on armed conflicts mostly localised in nature, which might underestimate the deeper scars on student learning outcomes of a full-scale war fought in Ukraine, implying the (mostly geographically concentrated) destruction of a large amount of physical educational infrastructure, the fall in the number of qualified and well-trained teachers and the losses in students' learning abilities in a broader sense. It is true, however, that some of these effects can be mitigated by online learning deployed during the Covid-19 experience.

Secondly, our estimates on learning losses concentrate on students in primary and secondary schools and exclude direct losses in tertiary education.

Finally, the war also generates high physical and psychological health impacts on the whole population that will leave scars for years. War trauma can have long lasting consequences on children' mental and physical health (Bürgin et al., 2022 and Kadir et al., 2019). However, those impacts are very difficult to quantify as they differ across people and depend on the intensity and duration of the conflict.

5. Concluding remarks and policy discussion

We have exploited a new stock measure of human capital combining the quantity and quality of education and adult skills to evaluate the long-term consequences of the war in Ukraine on the country's total factor productivity. Results show that losses in total factor productivity are estimated to plummet by about 7% by 2035 and that the negative effects will fade away only slowly over the following decades.

Remedial policy action, both in Ukraine and in countries hosting refugees, may attenuate these negative consequences. We will discuss here how OECD host countries have reacted to the crisis and how they could help attenuate the discussed negative effects coming from learning losses.

Schooling refugee children in the host countries can offset some of the adverse effects of school disruptions in Ukraine and might help them getting back to some security and stability. To be successful, the integration should follow principles learned from previous waves of migration. The approach should be global, including not only education but also social, emotional, and physical support (Cerna, 2019 and Koehler et al., 2022, OECD, 2022d).

Until May 2022, 2 million children (out of the total of 7.5 million) have fled Ukraine and 2.5 million have been internally displaced (UNICEF, 2022). One of the most important supports provided by European and non-European OECD countries is the access to public education for Ukrainian children. Many host countries have declared they wanted to send all refugee children from Ukraine to school. In May 2022, some countries have made good progress. Poland, receiving by far the largest share of refugees, has enrolled one third of refugee children into schools. In France, 65% of children were at school and in Germany and Italy, almost 40% of them were at school. At the same time, other host countries such as Hungary and Romania, sheltering important numbers of Ukrainian people fleeing the war zones, have failed so far to enrol refugee children in formal education (Table B1).

Some refugee children attend school in person while others follow the Ukrainian curriculum online from Ukraine. Some do both. To help children who do not speak the host country's language, many countries, such as Germany and Greece, provide language classes, while others, such as the Czech Republic, Luxembourg and Spain have hired native Ukrainian teachers or assistants (OECD, 2022a, 2022b).

In some countries, special support is granted to the youth wanting to pursue tertiary education. For instance, Austria, Belgium, Bulgaria, Denmark, France, Hungary, Latvia, Lithuania, Norway, Romania, Spain, Switzerland, and the United Kingdom provide various financial support to students to cover tuition fees and the costs of living. Moreover, some countries, such as France, provide financial support to the tertiary education sector while Austria, Italy, and Sweden help universities to hire Ukrainian professors (OECD, 2022a, 2022c).

To provide psychological support, Australia, Canada, and Turkey promote professional counselling at school. Children should be taught the host country's language at school while developing their mother tongue. Teachers need some help to better understand the refugees' situation and overcome the language and cultural differences (OECD, 2022e). Co-operation between the education systems and refugee organisations can be very useful in that respect (Cerna and McBrien, 2022). Formal education should be complemented by informal learning opportunities in sports or arts where refugee children may already have some experience to share with host children. Some countries such as Finland, Sweden and, to a lesser extent, the Netherlands, have developed individual education schemes for refugee children to better match their previous education, their needs, and their family situation (Cerna and McBrien, 2022).

References

Bager L., T.M. Laursen, N. Skipper and E. Agerbo (2021), “School performance of children whose parents suffered torture and war—a register-based study in Denmark”, *European Journal of Public Health*, 31(4), 749-755.

Becker T., B. Eichengreen, Y. Gorodnichenko, S. Guriev, S. Johnson, T. Mylovanonv, K. Rogoff and B. Weder di Mauro (2022), “A Blueprint for the Reconstruction of Ukraine”, *Rapid Response Economics 1*, CEPR.

Brück T., Di Maio M. and Miaari S. (2019), “Learning the hard way: The effect of violent conflict on student academic achievement”, *Journal of the European Economic Association*. 17(5), 1502-1537.

Bürgin, D., Anagnostopoulos, D., the Board and Policy Division of ESCAP. et al. (2022), “Impact of war and forced displacement on children’s mental health—multilevel, needs-oriented, and trauma-informed approaches”, *European Child & Adolescent Psychiatry*, 31(3), 845-853.

Card D., J. Kluve and A. Weber (2015), What Works? A Meta Analysis of Recent Active Labor Market Program Evaluations, IZA Discussion Paper No. 9236.

Cerna L. (2019), “Refugee education: Integration models and practices in OECD countries”, OECD Education Working Papers No 203.

Cerna L. and McBrien J. (2022), “Supporting Ukrainian refugee students”, OECD Education and Skills Today, Blog 8 April 2022.

Dinerstein M., R. Megalokonomou and C. Yannelis (2020), “Human Capital Depreciation”, CESifo Working Paper No. 8614.

Edin P-A and M. Gustavsson (2008), “Time Out of Work and Skill Depreciation”, *Industrial and Labor Relations Review*, 61(2), 163-180.

Égert, B. (2016), “Regulation, institutions and productivity: New macroeconomic evidence from OECD countries”, *American Economic Review*, 106(5), 109-113.

Égert, B., C. de la Maisonneuve and D. Turner (2022), “A new macroeconomic measure of human capital exploiting PISA and PIAAC: Linking education policies to productivity”, OECD Economics Department Working Papers, No. 1709.

Gorodnichenko Y, M. Kudlyak and A. Şahin (2022), “The Effect of the War on Human Capital in Ukraine and the Path for Rebuilding”, IZA Policy Paper No. 185.

Jarillo B., B. Magaloni, E. Franco and G. Robles (2016), “How the Mexican drug war affects kids and schools? Evidence on effects and mechanisms”, *International Journal of Educational Development*, 51(C), 135-146.

Johnson P.S and J. van Doorn (1976), “Skill Loss and Unemployment: A Note”, *British Journal of Industrial Relations*, 14(2), 202-205.

Jürges H., S. Luca, H. Sameh and A. Schwarz (2022), “Cohort at risk: long-term consequences of conflict for child school achievement”, *Journal of Population Economics,* 35, 1-43.

Kadir A., S. Shenoda and J. Goldhagen (2019), “Effects of armed conflict on child health and development: A systematic review”, *PLoS ONE.* 14(1). 1-37.

Kibris A (2015), “The Conflict Trap Revisited: Civil Conflict and Educational Achievement”, *Journal of Conflict Resolution*, 59(4), 645-670.

Koehler C., N. Palaiologou and O. Brussino (2022), « Holistic refugee and newcomer education in Europe: Mapping, upscaling and institutionalising promising practices from Germany, Greece and the Netherlands”, OECD Education Working Papers No 264.

Kyiv Independent (2022), “Ukraine’s unemployment rate record high amid war, but labor market recovering in some regions”. August 21. (kyivindependent.com)

Martin J.P (2014), Activation and Active Labour Market Policies in OECD Countries: Stylized Facts and Evidence on their Effectiveness, IZA Policy Paper No. 84.

Ministry of Economy of Ukraine (2023), The Ministry of Economy preliminarily estimates the fall in GDP in 2022 at the level of 30.4%, 5 January, 2023.

Monteiro J and R. Rocha (2017), “Drug Battles and School Achievement: Evidence from Rio de Janeiro’s Favelas”, *The Review of Economics and Statistics*, 99(2), 213-228.

National Bank of Ukraine (2022), Inflation Report July 2022.

OECD (2022a), Rights and Support for Ukrainian Refugees in Receiving Countries, OECD Publishing, Paris, https://doi.org/10.1787/09beb886-en

OECD (2022b), Supporting refugee students from Ukraine in host countries, https://www.oecd.org/ukraine-hub/policy-responses/supporting-refugee-students-from-ukraine-in-host-countries-b02bcaa7/

OECD (2022c), Spotlight on Tertiary Education: Findings from Education at a Glance 2022, https://www.oecd.org/education/education-at-a-glance/

OECD (2022d), Supporting the social and emotional well-being of refugee students from Ukraine in host countries, https://www.oecd.org/ukraine-hub/policy-responses/supporting-the-social-and-emotional-well-being-of-refugee-students-from-ukraine-in-host-countries-af1ff0b0/

OECD (2022e), The Ukrainian Refugee Crisis: Support for teachers in host countries, https://www.oecd.org/ukraine-hub/policy-responses/the-ukrainian-refugee-crisis-546ed0a7/

Ortiz-Correa J.S. (2014), “Math and Language at War: The Effect of the Colombian Armed Conflict on Math and Language Learning”, I*nternational Journal of Developing and Emerging Economics*, 2(3), 1-30.

Ortego-Marti, V. (2017), "Differences in skill loss during unemployment across industries and occupations," Economics Letters, Elsevier, 161(C), 31-33.

Pissarides C.A (1992), “Loss of Skill During Unemployment and the Persistence of Employment Shocks”, *Quarterly Journal of Economics*, 107(4), 1371-1391.

Rodriguez C and F. Sanchez (2010), “Books and Guns: The Quality of Schools in Conflict Zones”, Universidad de los Andes-Facultad de Economía. Documentos CEDE, 2010-38.

Sharkey P. (2010), “The acute effect of local homicides on children’s cognitive performance”, *Proceedings of the National Academy of Sciences of the United States of America*, 107(26), 11733–11738.

Annex A.

Table A1. Details of the studies estimating the effect of war or local violence on student performance

Authors	Country	Type of conflict	Duration of conflict	Identification strategy	Independent variables	Variable of interest	Control variables	Effect on student tests scores (measured as multiples of a standard deviation)
Bager et al, 2021	Denmark	Children whose parents suffered torture & war	8 years (2010-18)	Mean score difference between the exposed and non-exposed children estimated among those with at least one test score using a multilevel linear regression model, using restricted maximum likelihood estimation	Test score from the nationally standardised tests in primary and secondary grade levels, 2010-2018	Parental trauma	Child age at immigration, child-age congruence, parental mental illness, parental labour market status	-0.06 to -0.38
Bruck et al. , 2019	West Bank	Israeli–Palestinian conflict	6 years (2000-06)	The identification strategy exploits the within-school variation over time in the locality-level number of Palestinian fatalities occurring during the academic year in which the student takes the exam	Individual test scores in all subjects at the high-school final exam (Tawjihi General Examination) for the whole population of Palestinian students in the West Bank for all the academic years 2000-2006	Number of fatalities	Individual student characteristics, such as age, gender, stream of study, and religion; local-level economic variables and birth-cohort fixed effects	-1.02
Jarillo et al., 2016	Mexico	Drug related violence	5 years (2006-11)	School fixed-effects models	Math test scores	Drug-related turf war exposure defined as: when in at least one month during the academic year, the monthly number of firearm-related homicides in a locality surpasses a threshold of two standard deviations above its moving average of the previous four years	Control variables at school level and locality level, including school size, student–teacher ratio, and locality's population size	-0.04 to -0.02
Jurges et al 2020	West Bank	Israeli–Palestinian conflict	5 years (2000-05)	The identification strategy exploits the locality-level variation in the intensity of the Israeli-Palestinian conflict in the West Bank during the Second Intifada (2000–2005).	Grade Point Averages of children for the school year 2012/2013	Exposure, defined as the number of violent events during the Second Intifada reported by the household respondent (child's mother or father)	Individual covariates, including gender of the child, gender of the household respondent, refugee status, dummies for children's and parental age, indicators for the father's and mother's educational level, employment status of the father; a school type indicator (UNRWA vs. public school) and a set of locality-level labor market and institutional characteristics	-0.08 to -0.35

(continued)

Authors	Country	Type of conflict	Duration of conflict	Identification strategy	Independent variables	Variable of interest	Control variables	Effect on student tests scores (measured as multiples of a standard deviation)
Monteiro and Rocha, 2017	Brazil (Rio de Janeiro)	Drug battle	6 years (2003-09)	Reduced-form strategy that relies on the evidence that variation in conflicts within favelas over time is orthogonal to any other past and contemporaneous latent determinants of learning	Standardized test scores in math of student enrolled in the fifth grade, in year 2005, 2007 and 2009	Dummy that indicates whether the school is exposed to violent events throughout the academic year	Student socioeconomic characteristics such as students' gender, race, mother's education, age fixed effects, and dummy variables for whether the child has ever repeated a grade or dropped out in previous years. School characteristics and physical infrastructure	-0.05 to -0.12
Ortiz-Correa, 2014	Colombia	Armed conflict	3 waves: 2002-03, 2005-06, 2009	Cognitive achievement production function	Saber test scores for 5th, 9th and 11th grades	Armed Conflict Indicators such as extortions, terrorist attacks, kidnappings and mass murder victims	Gender and parental education for the 11th grade sample estimations, and location of the school (rural or urban) and type of school (public or private) for the 5th grade and 9th grade samples	-0.06 to -0.07
Rodriguez and Sanchez, 2010	Colombia	Armed conflict	7 years (1996-03)	Instrumental variables	Students' total score on the SABER 11 examination, normalised	Accumulated six-year armed conflict in the municipality instrumented by the accumulated six-years of per capita natural disasters in neighboring municipalities	Personal and family characteristics of the child as well as their average at the school level	-0.80
Sharkey, 2010	US (Chicago)	Local homicides	1994-02	Using neighborhood fixed effects specifications, the impact of a recent, local homicide is identified by comparing scores on cognitive assessments among children living within the same neighborhood who were assessed at different times (days or months following a local homicide)	Vocabulary and reading skills	Reported homicides occurring in Chicago from 1994 through 2002	Survey wave fixed effects, calendar year and month of year indicators	-0.50 to -0.66

Source: Authors compilation.

Annex B.

Table B1. The share of refugee children in formal education in host countries

(as of May 2022)

Country	Number of refugees (in 1000)	Number of refugee children (in 1000)	of which in school (in %)
Poland	3600	421	33.8
Romania	1021	398	0.6
Hungary	744	201	1.1
Germany	700	350	38.1
Slovakia	477	147	n.a
Czech Republic	354	129	23.1
Italy	125	41	39.1
Bulgaria	90	35	1.7
France	85	27	65.0
Spain	75	29	24.7
Estonia	32	11	31.9

Source: Authors' compilation based on data provided by National Authorities, UNHCR and the European Union.