CENTRE FOR ECONOMIC POLICY RESEARCH

CEPR

June 2022

The effect of the war on human capital in Ukraine and the path for rebuilding

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1 Introduction

In February 2022, Russia launched a full-scale invasion of Ukraine that has caused major destruction and loss of human life in the country. The war continues to have profound effects on the Ukrainian population. Rebuilding the country's economy and a plan to revive the economic and social livelihoods of Ukrainians are of foremost importance. Since World War II, the economic growth literature has extensively analysed the economic performance of various countries and has identified the accumulation of physical and human capital and technological catch-up as important factors for economic and social recovery (e.g., Christensen et al. 1980, Gilchrist and Williams 2004). In this Policy Insight, we focus on the effect of war on a country's human capital and identify key directions for rebuilding human capital in Ukraine.

We develop a simple framework for identifying the key channels of the human capital consequences of war. War has direct and immediate effects on the size of the workforce because of the increase in deaths, injuries and military mobilisation. In addition to these immediate adverse effects, there are various other channels that likely have long-lasting consequences. The disruption to schooling of younger cohorts, human capital depreciation due to loss of potential work experience and deterioration of health all contribute negatively and persistently to the human capital stock of a country. Identifying these persistent effects is important, since recovery critically relies on addressing them. Although our analysis is qualitative, we are able to combine our theoretical framework, findings from the existing literature and empirical evidence on the humanitarian impact of the war in Ukraine to develop directions for rebuilding human capital in Ukraine.

The rest of the Policy Insight is structured as follows. Section 2 outlines a simple model of a country's human capital and describes the channels through which war impacts human capital. Section 3 describes the humanitarian situation in Ukraine. Section 4 qualitatively summarises human capital losses using the framework outlined in Section 2. Section 5 outlines key directions for rebuilding of human capital. Section 6 concludes.

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4 The authors thank, without implicating, Bob Hall, Eric Hanushek, Sylvain Leduc, Viktor Tsyrennikov and Vitaliia Yaremko for useful comments.

2 Theoretical framework for the effect of war on human capital

Human capital is the skills, knowledge and experience possessed by an individual or population, viewed in terms of their value to a company or to a country. Human capital encompasses education, technical and job-related skills, health, mental and emotional wellbeing and other qualities. One of the first attempts to estimate the value of country's human capital was made around 1691 by Sir William Petty (Kiker 1966). The concept was then developed by Becker (1964), Schultz (1961) and Mincer (1958), among others. In this section, we lay out a parsimonious model of human capital to understand the possible channels for the impact of war on a country's human capital and, subsequently, that country's economic output.

2.1 MODEL OF HUMAN CAPITAL

Consider an economy that produces output using two inputs: physical and human capital. We can write the economy's production technology as:

$$Y_t = A_t K_t^{\alpha} H_t^{1-\alpha}, \tag{1}$$

where Y_t is output in period t, K_t is the stock of physical capital in t, H_t is the stock of human capital in t, A_t is a technology index, and $0 < \alpha < 1$.

The stock of country's human capital is the sum of the human capital stocks of working cohorts in the economy:[5]

$$H_t = \sum_{a=0}^{T} h_t(a)\, L_t(a), \tag{3}$$

where a captures a cohort's age at time t, $L_t(a)$ is the number of workers in cohort a at time t, $h_t(a)$ is the level of human capital of each member of cohort a at time t, and T is some high terminal age after which cohorts are not productive. A cohort is uniquely identified by its age a at time t.

The number of workers in a cohort evolves according to the following law of motion:

$$L_t(a) = (1 - d_t(a))\, L_{t-1}(a-1), \text{ for } a > 1 \text{ and given } L_t(0) > 0, \tag{3}$$

where $d_t(a)$ is the outflow rate of cohort a in t and $L_t(0)$ is the size of the newborn cohort in t. $d_t(a)$ encompasses the death rate as well as an outflow of individuals from civilian to the military sector.[6]

The human capital of each cohort evolves as follows:

$$h_t(a) = 0 \text{ for } a < s(t, a) \text{ and } a \geq T(t, a), \tag{4}$$

$$h_t(a) = f(t, a), \text{ for } a = s(t, a), \tag{5}$$

$$h_t(a) = (1 - \delta_t(a))\, h_{t-1}(a-1) + i_t(a), \text{ for } a > s(t, a), \tag{6}$$

5 The cohort approach is used, for example, by Bils and Klenow (2000).

6 The model does not incorporate migration out of the country and the return of people from abroad, although it can be extended to incorporate such migration. Those who emigrate do not lose their human capital, so those losses should be treated differently. Moreover, there could be direct returns to the country of origin through remittances from these emigrants.

where $\delta_t(a)$ is the depreciation rate of the human capital of cohort a in t, $i_t(a)$ is investment in the human capital of cohort a in t, $f(t, a)$ is the human capital from schooling, $s(t, a)$ is years of schooling, and $T(t, a)$ is the retirement age of the cohort defined by a in t. Note that $s(t, a)$, $f(t, a)$, and $f(t, a)$ remain fixed throughout the life of the cohort uniquely defined by (t, a).

Equations (4) to (6) show that a cohort starts to contribute to the country's aggregate human capital after completion of schooling. Once schooling is complete, at the cohort-specific age $s(t, a)$, each member of the cohort contributes $f(t, a)$ units of human capital. $f(t, a)$ captures the quantity and quality of schooling that cohorts receive. The quality of schooling can depend on the quality of teachers, curriculum, resources devoted to schooling and other factors.

A cohort's human capital depreciates at an annual rate of $\delta_t(a)$. This depreciation captures the deterioration of both skills and the cohort's health. Deterioration of skills can be due, for example, to the emergence of new technologies that require new skills and render ones obsolete.

The accumulation of human capital does not stop with schooling. Cohort a can continue building its human capital by investing in it, which is captured by the term $i_t(a)$. Investment in human capital can take the form of higher education, job training, or investment in physical and mental health.

Finally, after some age $T(t, a)$, a cohort retires and no longer contributes to the country's aggregate human capital.[7]

2.2 CHANNELS OF THE EFFECT OF WAR ON HUMAN CAPITAL

Our model of human capital helps map out various channels through which war affects a country's human capital and, subsequently, its aggregate output. There are two main channels – the size of the country's population and the productivity of its members.

- Size of workforce:
  - cohort outflow rate, $d_t(a)$, which encompasses the cohort death rate
  - size of the birth cohort, L_t(o)
  - age at which cohorts retire, $T(t, a)$
- Productivity:
  - years of schooling, $s(t, a)$
  - quantity and quality of schooling, $f(t, a)$
  - investment in human capital, $i_t(a)$
  - depreciation rate of human capital, $\delta_t(a)$, which captures loss of skills as well as deterioration of physical and mental health

All the effects of a war are negative. More importantly, given the dynamic nature of human capital, any impact in period t has long-lasting consequences for future human capital and, consequently, output.

While we set up the model in terms of an aggregate output, one can think of various ways (objective functions) in which a country values its people and their human capital. Here, we focus on human capital. War impacts a country's human capital as

7 The model can be extended to allow the retired cohorts contribute to schooling of the newborn cohorts (e.g., Bils and Klenow 2000).

well as its physical capital and technology index (see equation (1)). Tsyrennikov (2022) provides a parsimonious measurement framework for valuing output losses from lost potential growth. For a discussion of rebuilding and investments in both human and physical capital, see Blinov and Djankov (2022). KSE (2022) provides calculations of the direct damage caused to Ukraine's infrastructure during the war.[8]

3 The humanitarian situation in Ukraine

Since the start of the war, a large number of Ukrainian people have been killed or wounded. The Office of the United Nations High Commissioner for Human Rights (OHCHR) reports that the actual figures are considerably higher than the official statistics because the receipt of information from some locations where intense hostilities are ongoing has been delayed and many reports are still pending corroboration. As of 9 June 2022, OHCHR had recorded more than 9,500 civilian casualties in Ukraine (4,302 killed and 5,217 injured) (see Table 1 for the data sources in this section). Among those killed are 272 children.

The civilian casualties and destruction of civilian infrastructure forced people to flee their homes in search of safety. Since the start of the war, more than 4.9 million refugees have fled Ukraine.[9] As of the end of April, a further 7.7 million people were displaced internally and 13 million people were estimated to be stranded in affected areas of Ukraine or unable to leave due to heightened security risk, destruction of bridges and roads, or as lack of resources and information on where to find safety and accommodation.

Table 1 The humanitarian situation in Ukraine

	Number (1)	Reference period (2)	Source (3)
Total population	**43,467,000**	**2021**	1
Killed	4,302	24 Feb. to 9 June 2022	2
Injured	5,217	24 Feb. to 9 June 2022	2
Individual refugees from Ukraine recorded across Europe	4,904,207	28 Feb. to 9 June 2022	3
Internally displaced	7.7 million	24 Feb. to 29 April 2022	4
Stranded in affected areas	13 million	24 Feb. to 29 April 2022	4
Forcefully evacuated to the invading country	1.2 million	24 Feb. to 9 May 2022	5

Sources: (1) https://data.un.org/en/iso/ua.html; (2) https://ukraine.un.org/en/185529-ukraine-civilian-casualties-9-june-2022; (3) https://data2.unhcr.org/en/situations/ukraine; (4) https://data2.unhcr.org/en/documents/download/92353; (5) Jewers (2022).

Additionally, more than 1.2 million individuals were forcefully evacuated to the invading country against their will (Jewers 2022).

8 For the analyses of the effect of the Russian invasion from 2014 to February 2022, see Aslund (2018), Melnyk et al. (2019), Havlik et al. (2020) and Kharitonov (2020).

9 As of 9 June 2022, OHCHR had recorded 7,363,623 border crossing from Ukraine and 2,387,834 border crossings to Ukraine. These figures reflect cross-border movements (and not individuals) (source: https://data2.unhcr.org/en/situations/ukraine).

Summing up all the above-mentioned displaced populations (using data available as of 9 June) brings the total count to at least 26.2 million displaced individuals. This constitutes more than 60% of the entire population of Ukraine. And this figure does not take into account non-civilian losses.

4 The effect of the war on human capital in Ukraine

Using the framework outlined in Section 2, we identify the following channels through which the war is affecting human capital in Ukraine:

1. Quantity: loss of human life
2. Quality: impact on productivity of human capital through
   a. Schooling of children
   b. Adults' skills
   c. Physical and emotional health
3. Growth: impact on accumulation of human capital
4. Reallocation from the civilian to the military sector

Below, we describe some these channels in more detail. This qualitative analysis will help us lay out key directions for rebuilding, which we discuss in the next section. We leave the quantitative analysis to future work.

4.1 SCHOOLING OF CHILDREN

During a war, children experience disruption to schooling from being stranded in war-affected areas, from being displaced – either internally or to other countries – or from disruption to schooling without displacement. A long-standing literature documents that even small disruptions to schooling have large negative effects on learning.

Loss of schooling has an impact on an individual and on the aggregate level (Hanushek and Woessmann 2020). On an individual level, loss of schooling decreases lifetime earnings. For example, Hanushek and Woessmann (2020), summarising research on the economics of education, find that each additional year of schooling increases lifetime earnings by an average of 7.5–10%. On an aggregate level, loss of schooling lowers the accumulation of aggregate human capital, thereby lowering aggregate output growth.

Justino (2011) describes how the level of, and access to, education of civilian and combatant populations affected by violence has long-term human capital consequences. Ichino and Winter-Ebmer (2004) study the loss of human capital suffered by school-age children who received less education during World War II. They find that Austrian and German individuals who were ten years old during the conflict, or were more directly involved through their parents, received less education than comparable individuals from non-war-affected countries. They also show that these individuals experienced a sizable earnings loss some 40 years after the war, which can be attributed to the education loss caused by the conflict. Akbulut-Yuksel (2022) presents evidence from World War II and the Vietnam War on the detrimental effects of childhood war exposure on education, physical and mental health, and labour market outcomes, even decades after the conflict. Akbulut-Yuksel suggests that resources available during wartime are essential to reduce the enduring effects of war. Bruck et al. (2022) discuss the negative effects of war on academic achievement, concluding that governments of war-affected countries should focus on maintaining as much as possible appropriate social infrastructures and trying to counteract the psychological burden of experiencing violent events on children.

Furthermore, the impact of the war in Ukraine on schooling is layering on the impact of the Covid-19 pandemic. Hanushek and Woessmann (2020) find that a loss of one-third of a year in effective learning for students affected by school closures in early 2020 due to the pandemic will, by historical data, lower a country's GDP by an average of 1.5% over the remainder of the century.

4.2 HUMAN CAPITAL OF ADULTS

Massive internal displacements, reallocation to other countries and civilians becoming stranded in active war zones cause job loss.

Pindyuk (2022) reports, that according to a representative survey conducted in Ukraine by Info Sapiens during 24–28 March 2022, unemployment in Ukraine reached 29%. Among those who had not lost their job, only 37% received their March salary in full and 26% did not receive any salary at all. Astrov et al. (2022) report that economic activity has practically ceased in the regions that have come under attack, with the exception of the maintenance of public utilities, basic retail trade and medical services, where possible. The authors further report that the Ukrainian finance minister estimates that by mid-March 2022, the war had forced 30% of the economy to stop working and that, according to the Ministry of Economy, the losses from the war so far could amount to between a third and a half of the country's GDP in 2022. The International Labor Organization estimates that as of May 2022, 4.8 million jobs had been lost since the beginning of the war, equal to 30% of pre-war employment in the country (ILO 2022).

There are at least two ways in which the human capital of adults who lose their jobs deteriorates. First, human capital deteriorates when people are not working. Although there is some variation in estimates of how quickly this occurs, Blundell et al. (2016) and Dinerstein et al. (2020) suggest that a year without work reduces human capital by between 4% and 8%. Second, the post-war economy might require a different set of skills.[10] The evidence from the 'China shock' in the US and other countries suggests that labour adjustment may be slow and costly (see Autor et al. 2016 for a survey).

4.3 REALLOCATION FROM THE CIVILIAN TO THE MILITARY SECTOR

The war has led to a large reallocation of civilians to the military sector. The numbers of deaths and injuries reported in Section 3 refer to the civilian population; they do not take into account losses and injuries to the military. This is an important part of the country's human capital and its strategy for rebuilding this in future. We leave this as a direction for future research.

5 Directions for rebuilding human capital

The parsimonious model of human capital in Section 2 allows perfect substitution between the number of people in each cohort and their level of human capital as well as substitution of human capital from different cohorts. While in the data the substitution is not perfect, we outline directions for rebuilding both the size of the population and, importantly, the level of human capital of each of its members.

10 For example, if coal mines in Ukraine are not operational after the war, miners will need to re-skill for other jobs.

We identify the following directions for rebuilding of human capital in Ukraine:

1. Quantity and quality of schooling for children
2. Quality of higher education
3. Training and retraining programmes for adults
4. Assistance for people with disabilities
5. Reintegration into the civilian sector
6. Population growth and fertility
7. Promotion of self-motivating mechanisms

5.1 SCHOOLING

The quantity and quality of schooling are key inputs into human capital growth. Quality includes the development of relevant curricula and the provision of resources for teachers and schooling infrastructure.

Heckman (1998), summarising a large body of literature, concludes that economic theory demonstrates that the returns to human capital investment are greatest for the young because, first, younger people have a longer horizon over which to recoup the return on their investments, and second, skill begets skill. In a later paper (Heckman 2006), he summarises evidence on the effects of early environment on child, adolescent, and adult achievement and concludes that lifecycle skill formation is a dynamic process in which early inputs strongly affect the productivity of later inputs.

Hanushek and Woessmann (2016) argue that the key determinant of GDP growth is not years of schooling but the quality of schooling – for example, the skills developed in schools. Specifically, their empirical model that includes years of schooling accounts for only 25% of the variance in country growth rates, compared with 79% when test scores, which measure the quality of schooling, are included.

Angrist et al. (2022) offer a number of policy suggestions for providing education to temporarily displaced children during the war in Ukraine: (1) opening classes for Ukrainian refugees in selected schools in neighbouring countries, as well as expanding schools in parts of Ukraine to which many internally displaced families have moved; (2) online, by-phone, or in-person tutoring; and (3) adapting curricula – including printing textbooks in Ukrainian – in countries that receive refugees so that a large number of refugee children can regain access to standard schooling.

5.2 QUALITY OF HIGHER EDUCATION

Quality of higher education is one of the factors that helps build a country's human capital. Special attention should be paid to the skills of the future (e.g., Brynjolfsson and Mitchell 2017).

5.3 TRAINING AND RETRAINING PROGRAMMES FOR ADULTS

The large-scale displacement suffered by the Ukrainian population as a result of the war (see Sections 3 and 4.2) has led to loss of jobs. In the post-war economy, some jobs will return but some will be replaced by new jobs. The goal is to identify occupations and, more specifically, skills for the post-war economy and to establish training and retraining centres for the displaced adult population. Construction, civil engineering, health and information technology will likely be the key industries in the post-war economy, as well as the pre-war agricultural export industries.

5.4 ASSISTANCE FOR PEOPLE WITH DISABILITIES

Health is another factor that contributes to the quality of human capital. The number of people physically injured during the war continues to grow. In addition, while statistics on the emotional and mental impact of the war are scarce, the negative impact of wars on overall health is known to be large. In a review of the literature, Murthy and Lakshminarayana (2006) find that among the consequences of war, the impact on the mental health of the civilian population is one of the most significant. They discuss how studies of the general population show a definite increase in the incidence and prevalence of mental disorders.

Disability-inclusive infrastructure and workplace policies can empower and make it easier for people with disabilities to be part of the rebuilding and development. ICED (2019), for example, provides an outline of key challenges and opportunities in legislating for, designing and financing disability-inclusive infrastructure.

5.5 REINTEGRATION INTO THE CIVILIAN SECTOR

A separate focus should be on the reintegration of individuals serving in the armed forces of Ukraine or participating in the territorial defence forces (i.e., the military reserve component of the army) into civilian life after deployment, at least for those who choose to return to civilian life. This reintegration will require tailoring occupational training and health programmes to the specific needs of individuals who participated in combat activities (Angrist 1990).[11]

5.6 POPULATION GROWTH AND FERTILITY

Policies that focus on fertility can help boost human capital by increasing the size of new birth cohorts. Such policies may include a lump-sum payment for having a child and help with childcare costs.

5.7 ENCOURAGEMENT OF SELF-MOTIVATING MECHANISMS

Ukraine can encourage the accumulation of human capital by developing policies that motivate individuals' investment in their own human capital. These incentives can be fiscal as well as non-fiscal (e.g., Heckman 1998).[12] Self-incentives can be amplified by easier access to retraining, better labour markets and regulation, improved working conditions and other mechanisms that enhance quality of life. Justino (2022) argues that "based on evidence from other wars, the economic, social and political recovery of Ukraine will depend not only on bringing refugees back and reconstructing markets and infrastructure, but also on ensuring that social cohesion and trust in institutions are rebuilt so that any post-war Ukrainian government is able to succeed in maintaining a united population".

11 See, for example, Dunigan et al. (2020) for a review and analysis of practices across US federal agencies.

12 Becker et al. (2020) study the long-run effects of forced migration of Poles after World War II on investment in education, and find that Poles with a family history of forced migration are significantly more educated today than other Poles. The authors argue that these results are driven by a shift in preferences away from material possessions towards investment in human capital.

6 Conclusion

The war in Ukraine has led to catastrophic economic and humanitarian losses – deaths, injuries, displacements, as well as negative impacts on physical and mental health. It has had a substantial negative impact on the country's human capital that has the potential to last for a long period of time. And as the war continues, the losses will continue to mount.

In this Policy Insight, we have outlined possible directions for rebuilding human capital and development. Work along these directions requires a strategic plan for the development of the post-war economy in Ukraine as well as a quantitative assessment. This plan will require an agenda for the development of industries and occupations as well as for the general institutional and regulatory environment. Some of this work has already begun in a "Blueprint for the Reconstruction of Ukraine" (Becker et al. 2022).

References

Akbulut-Yuksel, M. (2022), "Unaccounted Long-Term Health Cost of Wars on Wartime Children", VoxEU.org, 10 May.

Angrist, J.D. (1990), "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records", *The American Economic Review* 80(3).

Angrist, N., S. Djankov, P. Goldberg and H. Patrinos (2022), "The Loss of Human Capital in Ukraine", VoxEU.org, 27 April.

Aslund, A. (2018), *Kremlin Aggression in Ukraine: The Price Tag*, Atlantic Council.

Astrov, A., M. Ghodsi, R. Grieveson et al. (2022), "Russia's Invasion of Ukraine: Assessment of the Humanitarian, Economic and Financial Impact in the Short and Medium Term", wiiw Policy Note/Policy Report 59.

Autor, D.H., D. Dorn, and G.H. Hanson (2016), "The China Shock: Learning from Labor-Market Adjustment to Large Changes in Trade", *Annual Review of Economics* 8(1): 205–240.

Becker, G.S. (1964), *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, Columbia University Press.

Becker, S.O., I. Grosfeld, P. Grosjean, N. Voigtlae, and E. Zhuravskaya (2020), "Forced Migration and Human Capital: Evidence from Post-WWII Population Transfers", *American Economic Review* 110(5): 1430–63.

Becker, T., B. Eichengreen, Y. Gorodnichenko, S. Guriev, S. Johnson, T. Mylovanov, K. Rogoff and B. Weder di Mauro (2022), "A Blueprint for the Reconstruction of Ukraine", VoxEU.org, 7 April.

Bils, M. and P.J. Klenow (2000), "Does Schooling Cause Growth?", *American Economic Review* 90(5): 1160–1183.

Blinov, O. and S. Djankov (2022), "Ukraine's Recovery Challenge", VoxEU.org, 31 May.

Blundell, R., M. Costa Dias, C. Meghir, and J. Shaw (2016), "Female Labor Supply, Human Capital, and Welfare Reform", *Econometrica* 84 (5):1705–1753.

Bruck, T., M. Di Maio, and S. Miaari (2022), "Learning the Hard Way: The Effect of Conflict on Education", VoxEU.org, 19 April.

Brynjolfsson, E. and T Mitchell (2017), "What Can Machine Learning Do? Workforce Implications", *Science* 358(6370): 1530–1534.

Christensen, L.R., D. Cummings, and D. Jorgenson (1980), "Economic Growth, 1947-1973: An International Comparison", in, J.W. Kendrick and B.N. Vaccara (eds), *New Developments in Productivity Measurement*, University of Chicago Press.

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

Dunigan, M., K.L. Gore, K.L. Kidder, M. Schwille, S. Cherney, and J. Sladden (2020), *Civilian Post-Deployment Reintegration: A Review and Analysis of Practices Across U.S. Federal Agencies*, Technical report, RAND Corporation.

Gilchrist, S. and J.C. Williams (2004), "Transition Dynamics in Vintage Capital Models: Explaining the Postwar Catch-Up of Germany and Japan", Federal Reserve Bank of San Francisco Working Paper 2004-14.

Hanushek, E.A. and L. Woessmann (2016), "Knowledge Capital, Growth, and the East Asian Miracle", *Science* 351 (6271): 344–345.

Hanushek, E.A. and L. Woessmann (2020), *The Economic Impacts of Learning Losses*, OECD Publishing.

Havlik, P., A. Kochnev, and O. Pindyuk (2020), "Economic Challenges and Costs of Reintegrating the Donbas Region in Ukraine", wiiw Research Report No. 447.

Heckman, J. (1998), "What Should Be Our Human Capital Investment Policy?", *Fiscal Studies* 19 (6271): 103–119.

Heckman, J. (2006), "Skill Formation and the Economics of Investing in Disadvantaged Children", *Science* 312 (5782): 1900–2.

ICED – Infrastructure and Cities for Economic Development (2019), *Delivering Disability Inclusive Infrastructure in Low-Income Countries*.

Ichino, A. and R. Winter-Ebmer (2004), "The Long-Run Educational Cost of World War II", *Journal of Labor Economics* 22(1): 58–86.

ILO – International Labor Organization (2022), "The Impact of the Ukraine Crisis on the World of Work: Initial Assessments", ILO Briefing Note, 11 May.

Jewers, C. (2022), "Putin has forcibly deported 1.2MILLION Ukrainians to Russia and put them in 'filtration camps' – including mother of four-year-old girl who 'was snatched off the street and separated from her daughter'", *Mail Online*, 9 May. May 9.

Justino, P. (2011), "Violent Conflict and Human Capital Accumulation", Institute of Development Studies Working Paper No. 379.

Justino, P. (2022), "The War in Ukraine: Civilian Vulnerability, Resilience, and Resistance", VoxEU.org, 14 April.

Kharitonov, K. (2020), "System of Estimation of Losses of the National Economy during the Armed Conflict (War)", *Journal of Scientific Papers "Social Development and Security"* 10(6).

Kiker, B. F. 1966), "The Historical Roots of the Concept of Human Capital", *Journal of Political Economy* 74(5): 481–499.

KSE – Kyiv School of Economics (2022), "Direct Damage Caused to Ukraine's Infrastructure during the War Has Reached over USD105.5 billion", 27 May.

Melnyk, N., A. Pavlyuk, M. Petrov, and O. Glushko (2019), *Armed conflict in the East of Ukraine: the damage caused to the housing of the civilian population*, Human Rights Publisher.

Mincer, J. (1958), "Investment in Human Capital and Personal Income Distribution", *Journal of Political Economy* 66: 281–302.

Murthy, R.S. and R. Lakshminarayana (2006), "Mental health consequences of war: a brief review of research findings", *World Psychiatry* 5(1): 25–30.

Pindyuk, O. (2022), "Ukraine: Losses from the War Are Mounting", in *Overshadowed by War and Sanctions*, wiiw Forecast Report Spring 2022.

Schultz, T.W. (1961), "Investment in Human Capital", *American Economic Review* 51(1).

Tsyrennikov, V. (2022), "A Trillion-Dollar Question: What Russia Owes Ukraine", VoxEU.org, 6 April.

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