

DISCUSSION PAPER SERIES

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Closures**

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ABSTRACT

Lost Wages: The COVID-19 Cost of School Closures¹

Social distancing requirements associated with COVID-19 have led to school closures. In April, 192 countries had closed all schools and universities, affecting more than 90 percent of the world's learners: over 1.5 billion children and young people. Closures are expected to reduce schooling and lead to future losses in earnings. Starting from the assumption that every additional year of schooling translates to 8 percent in future earnings, this paper estimates and confirms the loss in marginal future earnings on the basis of a four-month shutdown. We also estimated the losses by level of education. The findings show that the school closures reduce future earnings. It is also likely that students from low-income countries will be affected most, where the earning losses will be devastating. These estimates are conservative, assuming closures end after four months, with schools re-opening in the new academic year, and that school quality will not suffer.

JEL Classification: I26, I20, J24

Keywords: education, earnings, COVID-19

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LOST WAGES: THE COVID-19 COST OF SCHOOL CLOSURES

Introduction

A quick estimate of the impact of school closures using the world's largest economy – the United States of America – shows what future earnings losses might be for the nation's 76 million students. A four-month absence of students from school could result in a life-time earnings loss of 2.6 percent – or just over \$1,300 a year. This may not sound like such a high a number. But when considered for the whole student population in the USA, the total lifetime loss totals \$2.5 trillion.¹

In mid-April, [UNESCO](#) reported that 192 countries had closed all schools and universities, affecting more than 90 percent of the world's learners: over 1.5 billion children and young people. While many governments are now reopening institutions or preparing to do so for a new academic year, millions of students worldwide have already lost as many as four months of in-person instruction.

Education is one of the most important drivers of human capital investment. When children lose out on education, they lose out on future opportunities, including economic benefits such as additional earnings, with far-reaching consequences. Some modeling suggests that the loss of learning during the extraordinary global crisis of World War II was still having negative impacts on former students' lives some 40 years later.² And the impact of lost learning is not limited to the individual level. For whole societies that were forced to close down education in 2020, there will likely be significant consequences far into the future.

In this paper, we estimate the costs in expected lifetime earnings to current students of the COVID-19 school closures, as well as how these losses will lead to reductions in gross domestic product (GDP) across low-, middle-, and high-income countries. These estimates are presented as relevant evidence to help governments shape their strategies for re-opening schools and universities, including investment in technology to support alternative delivery of education services where this is needed.

Lifetime earnings and productivity are just some of the COVID-19 costs borne by children and youth. School closures are also likely to affect children and youth's health and social well-being well into the future.³ Thus, our findings are lower-bound estimates of the full costs of the COVID-19 school closures to children and youth worldwide.

Evidence on the Costs of Previous Pandemics and Crises

Research indicates that the negative effects on earnings of previous pandemics are long-lasting. The 1918 influenza generated impacts that lasted into the 1980s.⁴ Cohorts in utero during the pandemic displayed reduced educational attainment, increased rates of physical disability, lower income, lower socioeconomic status, and higher transfer payments compared with other birth cohorts. Research suggests that pandemics reduce income by 5-9 percent.⁵

This reduction in income is similar to the reduction in earnings from fiscal crises. Research has shown, for example, that graduating in a recession year leads to earnings losses that could last a decade or more, especially for highly-educated youth in rigid labor markets.⁶ Altonji, Kahn, and Speer (2016) estimate that initial earnings losses incurred by recession-year college graduates in the U.S. are as high as 10 percent due to reductions in full-time work and wages. They also find a small but persistent reduction in wages after the initial earnings losses.⁷

Some researchers have produced several single-year estimates of the impacts of pandemics on GDP. Three cases illustrate some of the possible outcomes in a rapid onset pandemic: a mild case (as in the 1968 flu pandemic, cost of 0.7 percent of GDP), a moderate case (as in the 1958 flu pandemic, cost of 3.1 percent of GDP), and a severe case (as in the case of the 1918 pandemic, cost of 4.8 percent of GDP). Others have estimated even higher impacts of up to 10 percent a year based on lost productivity and other consequences during the outbreak, such as mortality, morbidity, and absenteeism from work.^{8,9}

While each pandemic is different, they all affect economic output. The Black Death (1347-1352), which led to the deaths of more than 75 million people around the world,¹⁰ devastated many urban areas, and led to a reduction in available labor and higher agricultural wages.¹¹ The Spanish Flu of 1918-1920 led to deaths of up to 100 million people¹² and curtailed economic activity, with negative effects lasting into the 1980s.¹³ The economic impact of the 2003 outbreak of severe acute respiratory syndrome (SARS) in the UK, France, Belgium, and The Netherlands was estimated at 0.5-2% of GDP.¹⁴

Past crises have led to persistent earnings declines lasting several years.¹⁵ In China, secondary school closures in rural areas immediately after the Cultural Revolution led to a sharp 35 percent decline in high school completion rates among the affected cohort and negative labor market outcomes a decade later.¹⁶ Importantly, research has shown that the losses in earnings due to crises are not distributed equally. Earnings for workers in lower paying jobs tend to be most strongly affected. More educated workers generally suffer less. As Nobel laureate Theodore Schultz (1975) argued, educated (or skilled) workers are better able to cope with the disequilibria brought on by events such as economic crisis because they can adapt to the changing needs of employers and new technologies. In addition, educated workers are better resourced to seek information about job opportunities from family, friends, advertisements, former employers, radio, and the labor bureau.¹⁷

In certain crises, the rates of return to education may rise due to the increased unemployment rates among the less educated. This creates a pool of unemployed less educated workers, which in turn dampens wages for this group.¹⁸ For example, in Argentina, during the volatile periods of 1992-2002, the earnings of educated workers were less affected by crises than those of less educated workers.¹⁹ In fact, urban households in Argentina with more educated heads (at the secondary or higher education level) experienced constant increases in family income during the Argentine crisis of the 1990s.²⁰ In contrast, urban households with less educated heads mostly experienced declines in incomes or experienced modest gains during certain years. Similar patterns have been observed in other countries during crises, including Greece, Latvia, Mexico, and the República Bolivariana de Venezuela.²¹

However, most previous research on returns to education has left unexplored the question of whether and to what extent the returns to additional years of schooling vary with educational quality. DeCicca and Krashinsky (2020)²² attempt to fill this gap by examining returns to schooling with three common measures of school quality: pupil-teacher ratio, relative teacher salaries, and length of the school year. They find evidence that returns to schooling do vary among U.S. states with varying degrees of school quality, especially with respect to relative teacher salaries.

Prior to COVID-19, several researchers across the world estimated the potential losses in GDP of school closures as part of a pandemic mitigation strategy. In the U.K., Sadique, Adams, and Edmunds (2008) found that closing all schools for four weeks would cost between 0.1 and 0.4 percent of GDP.²³ In the U.S., Lempel, Epstein, and Hammond (2009) estimate that the costs of closing schools for four weeks borne by current workers—due to absenteeism and productivity losses—represent a reduction in GDP by about 0.3 percent.²⁴ These estimates attempt to account for the one-time losses in GDP due to worker absenteeism and losses in productivity; they do not account for learning losses and future lifetime earning losses resulting from school closures, a main contribution of our paper.

Natural disasters that affect access to schooling have also been demonstrated to have long lasting effects. The devastating earthquake that occurred in Northern Pakistan in 2005 severely affected children in their critical first thousand days at the time. It has been estimated that this cohort of children could stand to lose 15 percent of their lifetime earnings.²⁵

Evidence on the Costs of COVID-19

In the case of COVID-19, Andresen, Bensnes, and Løkken (2020) attempted to quantify the costs of school closures in Norway and found a one-off loss of NOK 2.2 billion (US\$213.8 million) for the 5 percent of students whose progression was delayed, plus an additional NOK 1.7 billion (US\$165 million) for each day schools and kindergartens remain closed.²⁶ Their approach was to model for forfeited future personal returns to education as a result of school closures. To do this, they added an estimate for lost productivity among parents, faced with caring for their children at home during the shut-down. For the United States, assuming in-class instruction does not resume until January 2021, Dorn et al. (2020) estimate losses of US\$61,000 to US\$82,000 in lifetime earnings.²⁷ Also for the United States, it is shown that missing college this year could result in earnings losses of more than US\$90,000 over one's working life, thus eroding the value of a university degree.²⁸ In the United Kingdom, average lifetime earnings could be lowered by up to 3 percent amounting to an annual loss of £900.²⁹ Over a working lifetime of about 45 years this could theoretically amount to lifetime lost earnings of up to £40,000 in younger children.³⁰ In Canada, this year's class of high school and tertiary education graduates could lose CAN\$25,000 or more over the next five years if this year's annual youth unemployment rate reaches 28 percent.³¹

The evidence we present differs from these studies in three ways. First, it is global in scope. Second, it focuses on estimating lifetime losses in future earnings for the cohort of current students affected by the school closures, rather than the impact on working parents. Third, it includes estimates for higher as well as school level education.

A simulation of COVID-19 impact on learning loss considering three, five and seven months of school closures was recently published using data on 157 countries at the primary and secondary level.³² The authors found COVID-19 could result in a loss of between 0.3 and 0.9 years of schooling adjusted for quality, bringing down the effective years of basic schooling that students achieve during their lifetime from 7.9 years to between 7.0 and 7.6 years. Their findings suggest that students from the current cohort could, on average, face a reduction of up to \$1,400 in annual earnings. In present value terms, this amounts to up to \$25,000 in lost earnings over the typical working lifetime. Globally, a school shutdown of 5 months could generate learning losses that have a present value of \$10 trillion. Similarly, another global study found that if learning in grade three is reduced by one-third, roughly the amount of time many children are likely to be out of school, learning levels in grade 10 would be a full year lower than would have been the case in the absence of COVID-19.³³

We build on these studies by adding higher education students into the calculation. The 224 million young people globally who are studying at the tertiary education level account for around 15 percent of the world's learners. Meanwhile, just-in-time analysis from the United States using Bureau of Labor Statistics employment and wage shows how quickly COVID-19 had an impact on wages by mid-April 2020. The weekly wages of workers at the bottom quintile decreased by 6 percent on average between mid-February and mid-March and by 26 percent between mid-March and mid-April.³⁴ In Canada, data from the Labor Force Survey show that COVID-19 induced a 32 percent decline in aggregate weekly work hours among workers aged 20-64, alongside a 15 percent decline in employment.³⁵ In the United Kingdom, the collapse has been twenty times faster and much deeper than the Great Recession. More than a quarter of workers have lost at least half of their income due to the COVID-19 crisis.³⁶ Low income workers in developing countries may face a higher risk of income loss during the COVID-19 lockdown as it is less feasible to conduct their jobs from home.³⁷ Predicted earnings losses due to COVID-19 in India appear substantial.³⁸ According to a recent survey in the U.S., students have internalized these losses, as they expect less education, fewer job opportunities and lower earnings in the future.³⁹

Theoretical framework

We use human capital theory.⁴⁰ Time and money spent on education builds human capital, hence one should be able to estimate the rate of return on such investment in a way similar to investment in physical capital. The costs incurred by the individual are the foregone earnings while studying, plus the resource costs of schooling. Since in a majority of countries, basic education is available to children tuition-free, in practice the only economic cost to individuals is the foregone earnings. The private benefits amount to what a more educated individual earns above a control group of individuals with less education. "More" and "less" in this case usually refers to adjacent levels of education, for example, university graduates versus secondary school graduates (see Figure 1).

The private rate of return to an investment in a given level of education in such a case can be estimated by finding the rate of discount (r) that equalizes the stream of discounted benefits to the stream of costs at a given point in time. The Mincerian⁴¹ earnings function allows us to estimate an overall rate of return to one extra year of schooling. This has been applied widely in practically all countries in the world.⁴² This method involves the fitting of a function of log-wages, using years of schooling, years of labor market experience and its square as independent variables. In

where L is the total loss; PV is the present value of lost earnings; Y is the mean annual earnings; α is an adjustment factor to account for the part of the school year when schools were closed; r is the rate of return on one year of schooling; S is the total number of students; and β is an adjustment factor to allow for some distance learning during the period of school closure.

Previous studies have documented average rates of return to schooling by income level. The returns vary by country and country group, but not by very much (see Table 1).

Table 1: Returns to Schooling (Percent)

Income group	Returns
Low	9.3
Middle	9.2
High	8.2
World	8.8

Source: Psacharopoulos and Patrinos (2018)

We use an even more conservative estimate and assume that every additional year of schooling equates to about 8 percent in additional future earnings.⁴⁴ Therefore, the returns to education estimate, r , that we use here is 8 percent. We then use the number of months of education closures to estimate the loss in marginal future earnings. For example, if *Country X* closes its schools and universities for four months, – that is, 1/3 of the school year – then the loss in marginal future earnings would be 2.64 percent per year over a student’s working life. Therefore, our earnings adjustment for *Country X*, α , is 2.64 percent.

We use mean annual earnings, Y , of employees in 2011 PPP dollars from ILO or the World Bank JoIn database. The data is country-specific where available; otherwise we calculate the average for a country’s income class. The ILO (2020) data are from the ILOSTAT database (<https://ilostat.ilo.org/>, retrieved May 2020) and from the World Bank (2020b) the data is from the Global Jobs Indicators Database (<https://datacatalog.worldbank.org/dataset/global-jobs-indicators-database>, retrieved May 2020). We also adjust the aggregate loss by assuming that not all future workers will always be employed by giving a range of estimates based on labor force participation (Azevedo et al. 2020).

To estimate the present value (PV) of lifetime earnings, we assume a working life of forty-five years and a three percent discount rate for all groups. We use data for the total number of students, S , from [UNESCO](#).

We assume that some of the learning loss will be mitigated by distance learning measures. Therefore, we include β , an adjustment factor to allow for some distance learning during the period of school closure. We assume an optimistic level β , at 0.9, indicating that only 10 percent of students suffer learning loss due to the distance learning opportunities, a conservative estimate that assumes that having distance learning opportunities equates with learning. The actual learning losses might be considerably higher.⁴⁵ Our estimate of distance learning coverage comes from [UNESCO](#). Finally, we use [World Bank data](#) on GDP by country. We estimate total losses within a range by adjusting labor force participation between 0.7 and 1.0.

Findings

We apply our model and assumptions to the world’s country groups and to the world economy overall. The estimated present value loss in earnings at the individual level is US\$2,833 in low-income countries, US\$6,777 in middle-income countries, and US\$21,158 in high-income countries. At the global level, this loss is US\$11,117 at the individual level.

While this may not sound like too much of an individual price for young people to pay in the fight against COVID-19, a look at the impact for all affected students—more than 1.5 billion—is much more sobering. The total estimated losses range from US\$360 billion in low-income countries, to US\$6.8 trillion in middle-income countries, and US\$4.9 trillion in high-income countries. The global impact is US\$15.1 trillion. Even if we adjust to the lower bound estimate of labor force participation, these losses are still large. They range from US\$252 billion for low-income countries, to US\$4.8 trillion in middle-income countries, to US\$3.4 in high-income countries, and a global impact of US\$10.6 trillion.

In terms of *current year* GDP, by country income group, the losses range from 61 percent in low-income countries, 22 percent in middle-income countries, and 9 percent in high-income countries. At the global level future earnings losses represent about 18 percent of current global GDP. Even when we adjust for labor force participation, the losses range from 43 percent in low-income countries, 15 percent in middle-income countries, and 6 percent in high-income countries. Globally, these losses represent at least 12 percent of current global GDP (see Table 2).

Table 2: Cost of school closures due to earnings losses as a percent of GDP, by country income group and for the world

<u>Income Group</u>	<u>Losses as % of GDP</u>	
	(1)	(2)
Low	61	43
Middle	22	15
High	9	6
World	18	12

Notes: (1) assuming full labor force participation; (2) assuming 70% labor force participation.

Source: Authors’ calculations

The estimates clearly differ by country income group because there are many more students in middle-income countries and much higher earnings in high-income countries. The estimated losses for low-income countries are devastating given already low earnings, depressed growth forecasts, and higher levels of poverty. In middle-income countries, the estimated losses are also substantial, since more than 1 billion of the 1.5 billion students affected by school closures live in middle-income countries.

The last few decades have seen a tremendous growth in tertiary education enrollments; now more than triple what they were in the 1970s. The wage premium associated with obtaining a university

degree is also high and has been increasing over time. Since tertiary students tend to have higher wages, they will lose more in absolute terms than will students with lower levels of education. Of the 1.5 billion students affected by the COVID-induced school closures, 15 percent are in a tertiary level institution. On average, tertiary graduates earn almost twice as much as those with only secondary schooling, and 2.7 times more than those with less than secondary.

Therefore, in terms of annual losses due to COVID-induced school closures, tertiary graduates stand to lose \$725 a year, in present value terms, almost \$18,000 over a lifetime. Secondary school graduates will lose \$363 a year and almost \$9,000 over a lifetime, while those with less than secondary will lose \$272 a year and \$6,700 over a lifetime. But since most students around the world are in primary – at 49 percent – or secondary school – at 39 percent, then in terms of aggregate losses they will be much higher at the lower levels, between US\$6.5 and US\$9 trillion. But the earnings losses will hurt those with lower levels of schooling more as they are likely to move many people to a level of income that will make it difficult to meet basic needs. The proportionate impact on a low-wage earner is, therefore, greater in absolute terms as it will affect their ability to achieve food security, affording housing, and so on, compared with a relatively high-wage earner.

Discussion

We estimated the costs of COVID-19 school closures on lifetime earnings for today's enrolled students, and the losses in GDP for low-, middle- and high-income countries, for primary, secondary and tertiary education, as well as the world as a whole. Our estimates confirm previous findings⁴⁶ and we conclude that the costs of the COVID-19 school closures are troubling. The estimated present value loss in earnings at the individual level is US\$2,833 in low-income countries, US\$6,777 in middle-income countries, and US\$21,158 in high-income countries. At the global level, this loss is US\$20,404.

These figures may seem a manageable price for young people to pay in the fight against COVID-19 at an individual level. However, when taking into account all affected students—more than 1.5 billion worldwide - the final estimate is much more sobering. Our total estimated losses in foregone lifetime earnings for current enrolled students range from US\$252-\$360 billion in low-income countries, to US\$4.8-\$6.8 trillion in middle-income countries, and US\$3.4-\$4.9 trillion in high income countries. The total global losses amount to US\$11-\$15 trillion.

In terms of *current year* GDP, the losses range from 43-61 percent in low-income countries, 15-22 percent in middle-income countries, and 6-9 percent in high-income countries. At the global level the future earnings losses represent 12-18 percent of current global GDP. These estimates are in line with Azevedo et al. (2020)⁴⁷ – but differ because we include tertiary education but not the impact of lower levels of learning. They are also in line with country level analyses for the Czech Republic,⁴⁸ Norway,⁴⁹ Ghana,⁵⁰ and Malawi.⁵¹

One limitation of our research is that it does not sufficiently account for differences in the quality of schooling across countries. We also do not explicitly consider the impact of lost early childhood education opportunities. And we do not consider distributional aspects. It is expected that socioeconomically disadvantaged groups will fare worse in terms of income losses. Yet, it is most

likely that those from poorer backgrounds and lower levels of schooling will suffer most. We hope to address these questions in future research.

¹ Psacharopoulos, G., Patrinos, H.A., Collis, V., and Vegas, E. 2020. The COVID-19 cost of school closures. Brookings Institution Blog series Education plus development. <https://www.brookings.edu/blog/education-plus-development/2020/04/29/the-covid-19-cost-of-school-closures/>; Psacharopoulos, G., Patrinos, H.A., Collis, V., and Vegas, E. 2020. The COVID-19 cost of school closures. World Bank blog series Education for Global Development <https://blogs.worldbank.org/education/covid-19-cost-school-closures>.

² Ichino, A., and Winter-Ebmer, R. 2004. The Long-Run Educational Cost of World War II. *Journal of Labor Economics* 22(1): 57-86 <https://econpapers.repec.org/RePEc:ucp:jlabe:v:22:y:2004:i:1:p:57-86>.

³ Van Lancker, W., and Parolin, Z. 2020. COVID-19, school closures, and child poverty: a social crisis in the making. *The Lancet Public Health* 1(5): E243-244 [https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667\(20\)30084-0/fulltext](https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(20)30084-0/fulltext).

⁴ Almond, D. 2006. Is the 1918 influenza pandemic over? long-term effects of in utero influenza exposure in the post-1940 U.S. population. *Journal of Political Economy* 114(4): 672-712: https://www.jstor.org/stable/10.1086/507154?seq=1#metadata_info_tab_contents; Correia, S., Luck, S., and Verner, E. 2020. Pandemics Depress the Economy, Public Health Interventions Do Not: Evidence from the 1918 Flu. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3561560.

⁵ Almond, D. 2006. Is the 1918 influenza pandemic over? long-term effects of in utero influenza exposure in the post-1940 U.S. population. *Journal of Political Economy* 114(4): 672-712: https://www.jstor.org/stable/10.1086/507154?seq=1#metadata_info_tab_contents; Schwandt, H. 2017. The Lasting Legacy of Seasonal Influenza: In-Utero Exposure and Labor Market Outcomes. IZA DP No. 10589: <https://www.iza.org/publications/dp/10589/the-lasting-legacy-of-seasonal-influenza-in-utero-exposure-and-labor-market-outcomes>.

⁶ Cockx, B. 2016. Do youths graduating in a recession incur permanent losses? *IZA World of Labor*, 281 doi: 10.15185/izawol.281

⁷ Altonji, J.G., Kahn, L.B., and Speer, J.D. 2016. Cashier or Consultant? Entry Labor Market Conditions, Field of Study, and Career Success. *Journal of Labor Economics* 34(S1) (Part 2, January): S361-S401 <https://doi.org/10.1086/682938>.

⁸ Jonas, O.B. 2013. *Pandemic Risk*. Washington, DC: The World Bank: https://www.worldbank.org/content/dam/Worldbank/document/HDN/Health/WDR14_bp_Pandemic_Risk_Jonas.pdf; Burns, A., Mensbrugge D., and Timmer, H. 2006. Evaluating the economic consequences of avian influenza. Washington, DC: The World Bank: <http://documents.worldbank.org/curated/en/977141468158986545/Evaluating-the-economic-consequences-of-avian-influenza>

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- ⁹ Sidorenko, A.A., and McKibbin, W.J. 2006. Global macroeconomic consequences of pandemic influenza. Washington, DC: The Brookings Institution: <https://www.brookings.edu/research/global-macroeconomic-consequences-of-pandemic-influenza/>; Fan, V.Y., Jamison, D.T., and Summers, L.H. 2018. Pandemic risk: how large are the expected losses? *Bulletin of the World Health Organization* 96(2): 129-134: <https://www.who.int/bulletin/volumes/96/2/17-199588/en/>
- ¹⁰ Jordà, O., Singh, S.R., and Taylor, A.M. 2020. Longer-Run Economic Consequences of Pandemics. Federal Reserve Bank of San Francisco Working Paper 2020-09: <https://www.frbsf.org/economic-research/files/wp2020-09.pdf>
- ¹¹ Hamermesh, D.S. 2020. Coronavirus and the labor market. IZA World of Labor Opinion: <https://wol.iza.org/opinions/coronavirus-and-the-labor-market>
- ¹² Jordà, O., Singh, S.R., and Taylor, A.M. 2020. Longer-Run Economic Consequences of Pandemics. Federal Reserve Bank of San Francisco Working Paper 2020-09: <https://www.frbsf.org/economic-research/files/wp2020-09.pdf>
- ¹³ Almond, D. 2006. Is the 1918 influenza pandemic over? long-term effects of in utero influenza exposure in the post-1940 U.S. population. *Journal of Political Economy* 114(4): 672-712: https://www.jstor.org/stable/10.1086/507154?seq=1#metadata_info_tab_contents; Correia, S., Luck, S., and Verner, E. 2020. Pandemics Depress the Economy, Public Health Interventions Do Not: Evidence from the 1918 Flu. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3561560
- ¹⁴ Keogh-Brown, M.R., Smith, R.D., Edmunds, J.W., and Beutels, P. 2010. The macroeconomic impact of pandemic influenza: estimates from models of the United Kingdom, France, Belgium and The Netherlands. *Eur J Health Econ* 11: 543–554: <https://doi.org/10.1007/s10198-009-0210-1>.
- ¹⁵ Oreopoulos, P., von Wachter, T., and Heisz, A. 2012. The Short- and Long-Term Career Effects of Graduating in a Recession. *American Economic Journal: Applied Economics* 4(1): 1-29: <https://www.aeaweb.org/articles?id=10.1257/app.4.1.1>
- ¹⁶ Zhang, S. 2018. Effects of High School Closure on Education and Labor Market Outcomes in Rural China. *Economic Development and Cultural Change* 67(1): 171-191: <https://www.journals.uchicago.edu/doi/abs/10.1086/697564>
- ¹⁷ Rosenzweig, M.R. 1995. Why are there returns to schooling? *American Economic Review* 85:153-158: <https://www.jstor.org/stable/2117910?seq=1>
- ¹⁸ Card, D. 2001. Estimating the return to schooling: Progress on some persistent econometric problems. *Econometrica* 69(5): 1127-1160: <https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-0262.00237>

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- ¹⁹ López Bóo, F. 2010. Returns to Education and Macroeconomic Shocks: Evidence from Argentina. IZA Discussion Paper No. 4753: <https://www.iza.org/publications/dp/4753/returns-to-education-and-macroeconomic-shocks-evidence-from-argentina>; Fiszbein, A., Giovagnoli, P., and Patrinos, H.A. 2007. Estimating the Returns to Education in Argentina using Quantile Regression Analysis: 1992-2002. *Económica* 53(1-2): 53-72: <https://ideas.repec.org/a/lap/journal/555.html>
- ²⁰ Albornoz, F., and Menendez, M. 2002. Analyzing income mobility and inequality: the case of Argentina during the 1990s. DELTA Working Paper. Paris: DELTA: <http://www.depeco.econo.unlp.edu.ar/wp/wp-content/uploads/2017/06/semi061202.pdf>; Cruces, G., and Wodon, Q. 2003. Transient and chronic poverty in turbulent times: Argentina 1995-2002. *Economics Bulletin* 9(3): 1-12: <https://ideas.repec.org/a/ebl/ecbull/eb-03i30003.html>
- ²¹ Psacharopoulos, G., Velez, E., Panagides, A., and Yang, H. 1996. Returns to education during economic boom and recession: Mexico 1984, 1989 and 1992. *Education Economics* 4(3): 219-230: <https://www.tandfonline.com/doi/abs/10.1080/09645299600000022>; Patrinos, H.A., and Metzger, S. 2005. Returns to education in Mexico: An update. Processed, The World Bank, Human Development Network; Patrinos, H.A., and Sakellariou, C. 2005. Economic volatility and returns to education in Venezuela: 1992-2002. *Applied Economics* 38:1991-2005: https://www.researchgate.net/publication/24075775_Economic_Volatility_and>Returns_to_Education_in_Venezuela_1992-2002; Vilerts, K., Krasnopjorovs, O., and Brekis, E. 2017. Returns to education during and after the economic crisis: Evidence from Latvia 2006–2012. *Comparative Economic Research* 20(1): 133-157; <https://www.semanticscholar.org/paper/Returns-to-Education-During-and-After-the-Economic-Vilerts-Krasnopjorovs/91f584e6f6a0ee7c5cb13eb1c0e722e8738e5bec>; Cholezas, I., Kanellopoulos, C., Mitrakos, T., and Tsakloglou, P. 2013. The impact of the current crisis on private returns to education in Greece. *Economic Bulletin, Bank of Greece* 38: 33-63: <https://ideas.repec.org/a/bog/econbl/y2013i38p32-63.html>
- ²² DeCicca, P., and Krashinsky, H. 2020. Do Differences in School Quality Generate Heterogeneity in the Causal Returns to Education? NBER Working Paper 27089, Cambridge, MA: National Bureau of Economic Research (<https://www.nber.org/papers/w27089>)
- ²³ Sadique, M.Z., Adams, E.J. and Edmunds, W.J. 2008. Estimating the costs of school closure for mitigating an influenza pandemic. *BMC Public Health* 8: 135: <https://doi.org/10.1186/1471-2458-8-135>
- ²⁴ Lempel, H., Epstein, J.M., and Hammond, R.A. 2009. Economic cost and health care workforce effects of school closures in the U.S. *PLoS Currents* 1:RRN1051: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2762813/>
- ²⁵ Andrabi, T., Daniels, B., Das, J. 2020. Human Capital Accumulation and Disasters: Evidence from the Pakistan Earthquake of 2005. RISE Working Paper Series. 20/039. https://doi.org/10.35489/BSG-RISEWP_2020/039.

-
- ²⁶ Andresen M., Bensnes S., Løkken S. 2020. What does it cost to close the education sector? Calculation of costs of infection prevention measures against COVID-19 for human capital, study progression and productivity. Statistics Norway https://khrono.no/files/2020/04/15/RAPP2020-15_web.pdf.
- ²⁷ Dorn, E., Hancock, B., Sarakatsannis, J. and Viruleg, E. 2020. COVID-19 and student learning in the United States: The hurt could last a lifetime. McKinsey & Company.
- ²⁸ Abel, J.R., and Deitz, R. 2020. Delaying College During the Pandemic Can Be Costly. Federal Reserve Bank of New York Liberty Street Economics <https://libertystreeteconomics.newyorkfed.org/2020/07/delaying-college-during-the-pandemic-can-be-costly.html>.
- ²⁹ The DELVE Initiative. 2020. Balancing the Risks of Pupils Returning to Schools. DELVE Report No. 4. Published 24 July 2020. Available from <http://rs-delve.github.io/reports/2020/07/24/balancing-the-risk-of-pupils-returning-to-schools.html>.
- ³⁰ Adams, R. 2020. UK children could 'lose 3% of lifetime earnings' due to lockdown school closures. The Guardian Blog <https://www.theguardian.com/education/2020/jul/24/uk-children-could-lose-3-of-lifetime-earnings-due-to-lockdown-school-closures>.
- ³¹ Frenette, M., D. Messacar, and T. Handler. 2020. To what extent might COVID-19 affect the earnings of the class of 2020? STATCAN COVID-19: Data to Insights for a Better Canada. Statistics Canada Catalogue no. 45280001. Ottawa: Statistics Canada.
- ³² Azevedo, J.P., Hasan, A., Goldemberg, D., Iqbal, S.A., and Koen, G. 2020. Simulating the Potential Impacts of COVID-19 School Closures on Schooling and Learning Outcomes: A Set of Global Estimates. Policy Research Working Paper No. 9284. World Bank, Washington, DC <https://openknowledge.worldbank.org/handle/10986/33945>.
- ³³ Kaffenberger, M. and Pritchett, L. 2020. Failing to Plan? Estimating the Impact of Achieving Schooling Goals on Cohort Learning. RISE Working Paper Series. 20/038. https://doi.org/10.35489/BSG-RISEWP_2020/038.
- ³⁴ Berman, Y., 2020. The Distributional Short-Term Impact of the COVID-19 Crisis on Wages in the United States. arXiv preprint arXiv:2005.08763.
- ³⁵ Lemieux, T., Milligan, K., Schirle, T., and Skuterud, M. 2020. Initial impacts of the COVID-19 pandemic on the Canadian labour market. Working Paper Series No. 26, University of Waterloo, Canadian Labour Economics Forum (CLEF), Waterloo.
- ³⁶ Bell, D.N. and Blanchflower, D.G., 2020. US and UK labour markets before and during the Covid-19 crash. *National Institute Economic Review* 252: R52-R69.

³⁷ Lekfuangfu, W.N., Piyapromdee, S., Porapakkarm, P., and Wasi, N. 2020. On COVID-19: New Implications of Job Task Requirements and Spouse's Occupational Sorting. Covid Economics: Vetted and Real-Time Papers, May 1.

³⁸ Estupinan, X., Sharma, M., Gupta, S., and Birla, B. 2020. El impacto de la pandemia de COVID-19 en la Oferta Laboral, los Salarios y el Valor Agregado Bruto en India (Impact of COVID-19 Pandemic on Labour Supply, Wages and Gross Value Added in India). Available at SSRN: <https://ssrn.com/abstract=3637880> or <http://dx.doi.org/10.2139/ssrn.3637880>

³⁹ Aucejo, E.M., French, J.F., Ugalde Araya, M.P., and Zafar, B. 2020. The Impact of COVID-19 on Student Experiences and Expectations: Evidence from a Survey. NBER Working Paper No. 27392.

⁴⁰ As formulated by Becker, G.S. 1975. Human Capital, Chicago: University of Chicago Press; and Schultz, T.W. 1961. Investment in human capital. *American Economic Review* 51: 1-17.

⁴¹ Mincer, J. 1974. *Schooling, Experience, and Earnings*, New York: National Bureau of Economic Research.

⁴² See Banerjee, A.V. and Duflo, E., 2005. Growth theory through the lens of development economics. *Handbook of economic growth, 1*, pp.473-552; Peet, E.D., Fink, G. and Fawzi, W., 2015. Returns to education in developing countries: Evidence from the living standards and measurement study surveys. *Economics of Education Review*, 49, pp.69-90; and ⁴² Psacharopoulos, G., and Patrinos, H.A. 2018. Returns to investment in education: a decennial review of the global literature. *Education Economics* 26(5): 445-458: <https://www.tandfonline.com/doi/full/10.1080/09645292.2018.1484426>.

⁴³ <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

⁴⁴ Psacharopoulos, G., and Patrinos, H.A. 2018. Returns to investment in education: a decennial review of the global literature. *Education Economics* 26(5): 445-458: <https://www.tandfonline.com/doi/full/10.1080/09645292.2018.1484426>

⁴⁵ Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., and Liu, J. 2020. Projecting the potential impacts of COVID-19 school closures on academic achievement. EdWorkingPaper: 20-226. Retrieved from Annenberg Institute at Brown University: <https://doi.org/10.26300/cdrv-yw05>

⁴⁶ Azevedo, J.P., Hasan, A., Goldemberg, D., Iqbal, S.A., and Koen, G. 2020. Simulating the Potential Impacts of COVID-19 School Closures on Schooling and Learning Outcomes: A Set of Global Estimates. Policy Research Working Paper No. 9284. World Bank, Washington, DC <https://openknowledge.worldbank.org/handle/10986/33945>.

⁴⁷ Azevedo, J.P., Hasan, A., Goldemberg, D., Iqbal, S.A., and Koen, G. 2020. Simulating the Potential Impacts of COVID-19 School Closures on Schooling and Learning Outcomes: A Set of

Global Estimates. Policy Research Working Paper No. 9284. World Bank, Washington, DC <https://openknowledge.worldbank.org/handle/10986/33945>.

⁴⁸ Munich, D. 2020. 500 neviditelných miliard ve školství. Názory Aktuálně Blog <http://blog.aktualne.cz/blogy/daniel-munich.php?itemid=37080>.

⁴⁹ Andresen M., Bensnes S., Løkken S. 2020. What does it cost to close the education sector? Calculation of costs of infection prevention measures against COVID-19 for human capital, study progression and productivity. Statistics Norway: https://khrono.no/files/2020/04/15/RAPP2020-15_web.pdf.

⁵⁰ Quartey, P., Mensah-Abrampah, K.E., Wong, B., Lomborg, B., and Nordjo, R. 2020. A rapid cost-benefit analysis of moderate social distancing in response to the COVID-19 pandemic in Ghana.” Ghana Priorities Project. Copenhagen Consensus Center. https://www.copenhagenconsensus.com/sites/default/files/covid_brief_for_ndpc_ghana_final.pdf

⁵¹ National Planning Commission. 2020. Medium and long-term impacts of a moderate lockdown (social restrictions) in response to the COVID-19 pandemic in Malawi: A rapid cost-benefit analysis. African Institute for Development Policy (AFIDEP). <https://www.afidep.org/publication/medium-and-long-term-impacts-of-a-moderate-lockdown-social-restrictions-in-response-to-the-covid-19-pandemic-in-malawi-a-rapid-cost-benefit-analysis/>.