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COVID-19 Crisis, Impacts on Catholic Schools, and Potential Responses

Part I: Developed Countries with Focus on the United States

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The COVID-19 crisis has led to widespread temporary school closures and a deep economic recession. School closures have threatened children's ability to learn and later return to school well prepared. The impact of the economic recession is going to be even more devastating: first for students, but also for the ability of some Catholic schools to maintain their enrollment and remain sustainable financially in countries where they do not benefit from government support. This paper, the first in a set of two, looks at some of the likely impacts of the COVID-19 crisis on Catholic Schools in developed countries with a particular focus on the United States, a country not only hard hit by the crisis but also where Catholic schools are especially vulnerable to downturns. While Catholic schools may be able to respond to the immediate challenge of school closures among others through distance learning options, their ability to maintain enrollment during the economic downturn is less clear. How schools will respond to the twin challenges of ensuring learning during school closures and beyond, and remaining affordable for families at a time of economic stress, may affect whether they are able to maintain their comparative advantage. A key aim of the paper is to make Catholic school teachers and leaders aware of some of the discussions on how to respond to the crisis, and provide links to online resources that may be useful.

Keywords: COVID-19, Catholic Schools, OECD, United States

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Introduction

This paper, the first in a set of two on the likely impacts of the COVID-19 crisis on Catholic schools and potential responses, focuses on developed countries, and especially the United States, a country where Catholic schools have already faced difficulties in maintaining enrollment for some time (Wodon, 2017, 2018, in press-a, in press-b). A companion paper in this issue of the *Journal* focuses on developing countries, and especially sub-Saharan Africa (Wodon, in press-c). Developed countries including the United States have been hard hit by the COVID-19 crisis. At the time of writing, of the more than four million cases of coronavirus infections identified globally, about one third were recorded in the United States, with European countries rounding up the top five². The actual number of people infected is likely a multiple of those estimates given lack of widespread testing in many countries and the fact that many individuals with the virus are asymptomatic. Globally, of close to 300,000 death due to COVID-19, more than one fourth were in the United States, with European countries again rounding the top five. Actual figures are once more likely to be much larger due to underreporting. In the developing world, statistics on infections and deaths tend to be lower (at the time of writing), but this may be due to the fact that the pandemic hit those countries with a lag, and many have weaker systems for testing and reporting.

The impacts of the COVID-19 crisis on students and education systems, and in particular on Catholic schools, are likely to be major, both immediately due to school closures, but also in the short and medium term due to the risk of multiple surges³ from the pandemic and the associated economic crisis. Consider first school closures. In mid-April 2020, UNICEF reported that 191 countries had closed their schools completely, with most other countries closing them partially⁴. This had affected at least 1.6 billion learners or 91.3%

2 See the COVID-19 Dashboard from Johns Hopkins University at <https://coronavirus.jhu.edu/map.html> as well as the University of Washington website at <https://hgis.uw.edu/virus/>. Projections for the pandemic are available from the Institute for Health Metrics and Evaluation at <http://www.healthdata.org/covid>.

3 See https://www.cidrap.umn.edu/sites/default/files/public/downloads/cidrap-covid19-viewpoint-part1_0.pdf.

4 UNESCO has been tracking school closures globally at <https://en.unesco.org/covid19/educationresponse>. Data are also available from the World Bank at <https://tab.worldbank.org/#/site/WBG/workbooks/10839/views>. For the United States, see <https://www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html>.

of all children enrolled in school. Since then, some countries have started to reopen schools, including China, but in most countries, this will not take place before weeks or months, and in many cases, schools will remain closed until the end of the 2019-20 school year. The risk of reopening schools too early is for children to contribute to spreading the coronavirus, and possibly be affected themselves. Evidence from China suggests that children are less likely to be infected by the virus than adults, but also that they may have more contacts when schools reopen than adults, thus possibly contributing to the spread of the virus as much as adults (Zhang et al., 2020; on the risk of infection among children, see also Jones et al., 2020, for data from Germany). Apart from risks for families, teachers are also at risk. In many developed countries, a substantial share of teachers are older than 55 and this age group is especially at risk of serious health complications from the virus. At the national and sub-national levels, various studies are being conducted on the potential impact on the spread of the virus of reopening schools under various scenarios (as an example, for the Ile de France region which includes the capital city of Paris in France, see Di Domenico et al., 2020).

School closures are likely to have a wide array of negative impacts on children. Even if school networks have the capability of implementing distance learning programs of high quality, student learning is likely to be affected—both because students will be away from schools for months, but also because student learning suffers during recessions (Shores & Steinberg, 2019). Lack of access to school meals may also affect children's nutrition, in turn impacting learning negatively. Other potential consequences may include poor mental health, higher risks of violence at home, and a resulting exposure to toxic stress, as well as the risk for some students to simply drop out of school all together if the crisis makes the cost of schooling unaffordable for parents.

Some of these impacts may be indirect but nevertheless long-lasting. For example, if a lesser emphasis is placed on young children's development at home in order to prioritize activities for children of primary and secondary school age, this may impact young children's future for years to come because of poor early childhood development. Across the board and age groups, children from disadvantaged backgrounds are likely to suffer the most, not only because they often lack access to good distance learning options, but also because income losses for their parents due to unemployment or underemployment will affect them in other ways, including through a higher likelihood of dropping out and not returning to school when the crisis subsides. In low

income households, girls may be especially at risk as the prevalence of early childbearing and child marriage often increases during crises.

Consider next the economic impacts of the crisis that are also likely to be massive. The International Monetary Fund (2020) suggests that globally, the downturn will be the deepest recession since the Great Depression, with developed countries suffering from larger losses in GDP than developing countries. In Europe, the European Commission (2020) predicts a contraction in GDP of 7.5% for 2020, a much larger shock than during the great recession of 2009. In the United States, revised growth projections from the Congressional Budget Office are not yet available at the time of writing, but losses in jobs have been massive, with more than 33 million individuals claiming unemployment benefits in just six weeks, and the unemployment rate for April reaching 14.7%, although this does not include individuals who left the labor force or are underemployed.

The crisis will put pressure on state funding for public schools. It will also affect the financial sustainability of private schools, including many Catholic schools, as large increases in unemployment will lead to income losses for households and thus a reduced ability to afford tuition for a large swath of the population. This impact, which may be severe, is probably already being felt through drops in registrations for the next school year, but it may also hit Catholic schools with a lag.

Given concerns related to both school closures and the economic crisis, a simple two-step approach guides the analysis in this paper, with first a discussion of immediate impacts due to school closures, and next a discussion of likely short- to medium-term impacts due to the economic crisis and its implications for enrollment in Catholic schools (effects are already being felt for the next school year). A key question is whether with appropriate responses, Catholic schools will be able to keep their comparative advantage, or instead suffer from an erosion of their position in an increasingly competitive and constrained education market. The focus of the discussion is on primary (elementary) and secondary (middle and high) schools, as opposed to preschools or tertiary education, even if preschools as well as Catholic colleges and universities are also likely to suffer from the crisis (on trends in Catholic higher education globally, see Wodon, in press-d). In the case of colleges and universities, especially those with limited endowments who rely almost exclusively on tuition to fund their operations, this is in part because of a smaller number of international students are likely to enroll in the fall. But it is also because even though enrollment in tertiary education tends to increase dur-

ing recessions given a lack of attractive job opportunities, for many individuals right now, going back to school or staying in school may not be feasible due to income losses and reductions in spending.

Apart from discussing risks, the paper discusses potential responses by schools and governments. For Catholic school responses, part of the analysis in the paper relies on a small online survey implemented with the International Office of Catholic Education (*Office Internationale de l'Enseignement Catholique* in French or OIEC). The survey was sent at the end of April 2020 to national Catholic education associations that are members of OIEC. A total of 171 responses were received from 31 countries at the time of writing. The survey was used to inform three conference calls held in French, English, and Spanish in early May with participation from representatives of national associations. Apart from survey responses, discussions during these conference calls also helped inform the paper.

The paper is structured as follows. The first section discusses temporary school closures and how they may affect schools and students right now, as well as potential responses with a focus on distance learning since this is the area under the control of the schools themselves. One of the objectives is to provide links to practical resources that school administrators and teachers can rely upon to improve the quality of online teaching and of materials they share with students⁵. Thereafter, the risk of losses in enrollment for Catholic schools are considered given the strains for affordability that the crisis will bring for many parents. The analysis suggests that schools in many countries may be affected by the crisis, but in the United States in particular, schools are vulnerable in comparison to other OECD countries. Losses in enrollment in Catholic schools in the country could be substantially more severe than what was observed during the great recession. Next in terms of responses, the analysis notes that while Catholic schools in the United States may be able to apply for relief under provisions of the Coronavirus Aid, Relief, and Economic Security (CARES) Act, the impact on enrollment relates to broader challenges that Catholic schools are already facing and which are being exacerbated by the current crisis. It is suggested that Catholic schools may face trade-offs to maintain their comparative advantage in an increasingly competitive and constrained education market. A brief conclusion follows.

5 For a nice list of resources managed by Tim Uhl, the superintendent of Catholic Schools for Montana and editor of the weekly Catholic School Matters newsletter, see https://docs.google.com/document/d/1Sw-NC4Ym4ZURO9r9UI_Fdnsuc9GfD6M-u1Iz-tEPyXt4/edit.

Immediate Impacts from the Crisis

Risks from the Crisis

Immediate challenges from school closures relate among others to: (a) losses in learning and the risk for some children to even drop out of school; (b) losses in well-being and mental health; and (c) losses for children from disadvantaged groups of free or subsidized lunches provided in schools.

Consider first losses in learning. Research for the United States suggests that children suffer substantial from learning losses during the summer, especially if they are from disadvantaged backgrounds (Alexander et al., 2007; Cooper et al., 1996; Gerhenson, 2013; Quinn & Polikoff, 2017). The same is likely to happen during COVID-19 related school closures, especially for disadvantaged children who are less likely to have access to broadband internet for quality distance learning, and are also less likely to have parents who can supervise their learning at home. These children may also not have conditions at home that are conducive to learning, such as a space to work and study, and they may be exposed to more stress. Kuhfeld and Tarasawa (2020) estimate that due to the COVID-19 crisis, students may return to school in the Fall with only 70% of the learning they would have achieved in a typical year for reading, and less than 50% of the normal learning for mathematics.

Children in Catholic schools will experience learning losses too, and some may be at risk of losing benefits from the so-called Catholic school advantage (see for example Hallinan & Kubitschek, 2013, and Freeman & Berends, 2016). There is no doubt that on average, students in Catholic schools tend to learn more, or at least perform better on standardized tests, than those in public schools. In the United States, data from the National Assessment of Educational Progress suggest that the difference in test scores is mostly due to a smaller proportion of students performing very poorly (Wodon, 2017). These statistical comparisons however do not necessarily imply that Catholic schools themselves do a better job than public schools. Yet while there is no consensus on this issue in the literature (see for example Jepsen, 2003, and Elder & Jepsen, 2014), a majority of the studies on this issue tend to suggest that especially for disadvantaged students, there may be some benefits from enrolling in Catholic schools. But in the current context, these are the students who stand to lose the most from school closures, in part because they lack access to digital materials and support for learning at home. Even when

students have access to digital material, there is no guarantee that they will access them⁶.

Consider next losses in well-being and mental health. Globally, the World Health Organization estimates that between 10 % and 20 % of children and adolescents experience mental health disorders⁷. Data from school health surveys suggest that even before the current crisis, many adolescents experienced various forms of distress. For developed countries, the main school health survey is the Health Behaviour in School-aged Children Survey (HBSC). Indicators include perceived health (self-assessment of health, having headaches, having stomachaches, having backaches, difficulty sleeping), risky behaviors (ever had sex, ever smoked, ever drank alcohol, ever used cannabis) and psychological well-being (feeling low, feeling irritable, feeling nervous, and feeling dizzy). Close to half of students expressed having headaches, stomachaches, backaches, difficulties sleeping, and feeling low in the last round of the survey. Close to two thirds mentioned feeling irritable or nervous (Wodon et al., 2020). Some of these conditions especially for mental health may be exacerbated by the current crisis.

Students in Catholic schools may do better on some of these metrics in part because the schools work hard at promoting a sense of community, and parents are often more engaged in a positive way in supporting the schools. This is one of the reasons why the loss of a Catholic school is often a loss for the community (Brinig and Garnett, 2014). In addition, violence in schools plays an important role towards low levels of wellbeing among students, and the prevalence of violence in schools tends to be lower in religious schools, at least in the United States. There is also some evidence that Catholic schools may do a good job at imparting values among their students (Green et al., 2018a, 2018b), which may again help for resilience but this remains somewhat conjectural. In any case, even if students in Catholic schools may have some degree of protection against losses in well-being and mental health, many will not be immune to the increase in stress brought about by the crisis and the effects of social distancing.

Consider finally losses of free or subsidized school lunches. In the United States alone, 29.6 million children benefitted in 2019 from the National School Lunch Program⁸. Among those, 20.1 million benefitted from free lunches (these are children in households with incomes at or below 130 % of the poverty line), and another 1.7 million benefitted from subsidized lunches. In addition, 14.8 mil-

6 See the AP story at <https://apnews.com/17b75096b95315d6e4d6bb9fb7fbb573>.

7 See https://www.who.int/mental_health/maternal-child/child_adolescent/en/.

8 See <https://fns-prod.azureedge.net/sites/default/files/resource-files/slsummar-4.pdf>.

lion children also participated in the breakfast program run by the Department of Agriculture, including 11.8 million children receiving free breakfasts and 0.7 million receiving subsidized breakfasts. These programs are massive, and their loss can lead to hunger among children who previously benefitted from them. States are implementing alternative distribution models⁹, but not all students are being reached. The loss of meals will be felt deeply by children in poverty, especially as many low income parents may have lost jobs or may be at high risk of unemployment due the crisis. Children in or near poverty are thus likely to be impacted twice, not only by the loss of school lunches, but also by income losses in their household. Results from the COVID-19 Impact Survey suggest that by the end of April 2020, food insecurity affected 1 in 5 households in the United States, and an even larger share of households with children 12 and under¹⁰.

Children enrolled in Catholic schools will also be affected since the schools can participate in these federal programs, and many do. While the share of low income students in Catholic schools in the United States has decreased over time (Murname & Reardon, 2018), the schools still welcome many children from disadvantaged backgrounds. Data for the 2019-2020 school year from the National Catholic Education Association (NCEA, 2020) suggest that at a minimum (the data are incomplete), 2,717 schools participated in the school lunch programs, out of a total of 6,183 Catholic schools (4,995 elementary schools and 1,188 secondary schools), with as a result close to 326,000 students receiving subsidized meals in the schools.

Data on how worried the staff of Catholic and other private schools are about various immediate risks have been collected through a survey implemented by Hanover Research (2020) for EdChoice in April 2020. While the survey is not nationally representative¹¹, it is nevertheless instructive, especially as 61% of all respondents are from Catholic schools, which makes separate analysis for those schools feasible. Table 1 provides comparative statistics for all schools and for Catholic schools on the share of respondents perceiving some of the immediate risks as extremely worrying, very worrying, moderately worrying, slightly worrying, and not worrying at all (a similar Table is provided for short- and medium-term risks in the next section, acknowledging that the distinction between immediate and short/medium-term risks is necessarily imperfect). The various risks are ranked in the table according

9 See for example for Louisiana <https://cnp.doe.louisiana.gov/ServingSites/>.

10 See <https://www.covid-impact.org/results>.

11 For example, FL accounts for 29% of all respondents versus only 2% for NY.

to the share of respondents extremely or very worried in the overall sample. The top two worries are related to the ability of schools to collect tuition for the remainder of the year (this relates to their financial sustainability, which is discussed in more detail in the next section) and the risks for students or their families of contracting COVID-19. The next three worries concern students with special needs, who may be losing the support they need, students falling behind academically, and students missing out on learning because of lack of access to the internet. The last three worries relate to students not having enough food to eat, affluent students pulling away because they have

Table 1

	Extremely worried	Very worried	Moderately worried	Slightly worried	Not at all worried
All private schools					
Collecting tuition for remainder of the year	19	22	26	24	9
Students or families contracting COVID-19	13	20	36	26	5
Special needs students losing needed support	9	17	28	30	16
Students falling behind academically	10	15	33	33	9
Students w/o internet missing out on learning	6	11	21	36	26
Students not having enough food to eat	5	9	16	33	36
Affluent students pulling away (resources at home)	2	10	20	27	41
Students experiencing/witnessing abuse at home	4	6	16	43	31
Catholic schools					
Collecting tuition for remainder of the year	20	24	25	26	5
Students or families contracting COVID-19	14	23	35	24	4
Special needs students losing needed support	8	18	32	30	12
Students falling behind academically	8	16	38	30	8
Students w/o internet missing out on learning	4	11	20	39	26
Students not having enough food to eat	5	8	15	37	34
Affluent students pulling away (resources at home)	4	11	21	26	38
Students experiencing/witnessing abuse at home	3	6	16	47	28

Note. Source: Hanover Research (2020).

more resources to learn at home, and students experiencing or witnessing abuse at home. Typically, there are few differences between respondents from Catholic and other schools in terms of the shares rating risks as extremely worrying, very worrying, moderately worrying, slightly worrying, or not worrying at all.

Data are also available in the United States on parental perceptions of risks related to the COVID-19 crisis. For example, EdChoice maintains a monthly public opinion tracker¹² (i.e. opinion poll) which has recently included questions on the pandemic. At the time of writing, the latest report available was for April 2020. Among various categories of risks related to COVID-19, parents were most concerned about their child getting exposed to the coronavirus at school, followed by their child missing instruction time, and the cancellation of after school activities or other programs run through schools. Comparatively fewer parents were concerned about missing work if their child's school is closed, explaining the coronavirus to their child, and making up for free or reduced-price meals at home. Most parents have felt prepared for school closures and online learning, but some have not. Answers to these questions are, however, likely to depend on the socio-economic background of parents.

The above discussion focuses on the United States in order to be able to go a bit more in-depth in the analysis, but many of the above risks are also at work in other developed countries. One of the useful websites with materials related to the crisis in Europe is maintained by the European Commission¹³. A wide range of analyses are also being conducted at the country or sub-national level.

Potential Responses

For each of the main three risks mentioned above, as well as for the more detailed list of risks mentioned in the Hanover research (2020) report, what can schools, and in particular Catholic schools, do to protect children? The ability of schools to respond directly to the loss of free or subsidized lunches as well as losses in well-being and mental health are limited. Broader societal responses tend to be required since the schools themselves cannot reach children easily with responses in these areas when they are closed. However, to reduce losses in learning, distance learning offers opportunities, although not all school networks may be ready to take advantage of those opportuni-

12 See <https://edchoice.morningconsultintelligence.com/downloads/>.

13 See <https://eacea.ec.europa.eu/national-policies/eurydice/news>.

ties even in developed nations. There is also likely to be substantial variance between schools, and within school between teachers, in the ability to use online content to optimally promote learning. Finally, there is heterogeneity among students and a risk that ICT solutions for distance learning may widen further gaps in educational outcomes between disadvantaged children and those from more privileged backgrounds.

Are schools ready to use technology for distance learning? To answer this question, Moreno and Gortazar (2020) conduct a simple analysis of responses by principals in surveys from the 2018 Programme for International Student Assessment (PISA). Countries participating in PISA include not only OECD countries, but also a few other high income countries as well as a range of middle income countries, some of which are doing quite well in terms of education outcomes, especially in East Asia. Several questions are asked to principals, including whether they believe that students are in a school with an effective online learning support platform, whether teachers have the necessary technical and pedagogical skills to integrate digital devices in instruction, and whether effective professional resources for teachers to learn how to use digital devices are available. Positive response rates are higher for the second and third questions than for the first, but it is striking that overall, OECD countries do not necessarily do much better than middle income countries. In both types of countries, a substantial minority of students attend schools that are not ready for digital learning according to principals. As another data point on school readiness for distance learning, the latest Teaching and Learning International Survey (OECD, 2018a, 2018b) suggests that only 43 percent of teachers in the OECD and 45 percent in the United States feel well or very well prepared to use ICT in their classrooms.

Since the emergence of the crisis, a wide range of organizations have provided guidance and resources for schools and education systems to improve readiness for distance learning. Sorting through the multiple policy notes and opinion pieces as well as the many websites providing materials is not easy, but a report published with the OECD by HundrED (2020) identifies ten websites with resources curated in a particularly useful way (the report also provides many other useful tools and resources). Wide Open School¹⁴ provides a collection of online learning experiences for children curated by Common Sense editors. UNESCO¹⁵ lists a range of educational applications, platforms and resources that can facilitate distance learning and provide

14 See <https://wideopenschool.org/>.

15 See <https://en.unesco.org/covid19/educationresponse/solutions>.

psychosocial support during school closures. ISTE and EdSurge¹⁶ compiled guidance on how schools can cope with coronavirus and helped launch the Learning Keeps Going¹⁷ website. Stories and updates on the crisis in the United States are available on the *New York Times*' learning network¹⁸. The Distance Learning Resource Center from Education Reimagined¹⁹ is another source of guidance and ideas, as is the list of resources compiled by the National Board for Teaching Standards²⁰. While many of these resources focus on the United States, Top Remote Learning Solutions²¹ focuses on experiences in Nordic countries. Koulu²² in Finland provides tools for distance learning, as does the Emerson Collective in the United States²³. This list is by no means exhaustive, but it is a great starting point.

For the United States, the Department of Education²⁴ also has useful resources related to programs and policies including how relief funds under the CARES Act may be used (guidance on how the CARES act applies to school was released at the end of April²⁵). Globally, the World Bank²⁶ also maintains a webpage with resources related to the impact of the crisis on schools, but while the site does track policy responses by developed countries as well as developing countries, most of the guidance notes on policy options apply primarily to developing countries (these guidance notes are discussed in the companion paper on the impacts of the crisis in the developing world).

While none of the above resources focus on Catholic schools, they are relevant. Also relevant are compilations of responses adopted by public school districts (there are more than 13,000 such districts in the United States, each of them fairly autonomous in terms of its policies). As mentioned in a *New York Times* article²⁷, the Center for Reinventing Public Education has

16 See <https://www.edsurge.com/research/guides/navigating-uncertain-times-how-schools-can-cope-with-coronavirus>.

17 See <https://www.learningkeepsgoing.org/>.

18 See <https://www.nytimes.com/2020/03/11/learning/coronavirus-resources-teaching-learning-and-thinking-critically.html>.

19 See <https://education-reimagined.org/distance-learning-resource-center/>

20 See https://docs.google.com/spreadsheets/d/1UYhVO0vH84Nfv2NZuAFttvK6x8ICI3dl-7x-jqUiR_E/edit#gid=0.

21 See <https://education-nation.99math.com/>.

22 See <https://koulu.me/>.

23 See <https://www.emersoncollective.com/>.

24 See <https://www.ed.gov/coronavirus>.

25 See <https://oese.ed.gov/files/2020/04/FAQs-Equitable-Services.pdf>.

26 See <https://www.worldbank.org/en/topic/edutech/brief/edtech-covid-19>.

27 See <https://www.nytimes.com/2020/04/23/education/learning/coronavirus->

created a database²⁸ to track responses to the crisis. At the time of writing, information was available for 82 districts serving almost nine million students. Examples of responses include Miami-Dade County's provision of 110,000 tablets and other mobile devices to students, Richmond's offering of online tutoring sessions, and webinars for parents to better understand the digital tools used by schools in many districts.

In terms of materials collated for Catholic schools specifically, some guidance is available in the United States from the National Catholic Education Association²⁹, including through its weekly Catholic Matters Newsletter which has provided valuable links on this issue as on many others³⁰. Another useful resource is the Arrupe Virtual Learning Institute whose e-courses may be especially useful for subjects with limited enrollment that make it more difficult for individual schools to allocate the resources to develop quality distance learning. The Institute has held sessions during the crisis open to all Catholic schools and it maintains a COVID-19 Shared Wisdom Document with useful links³¹. Catholic Universities have provided support as well. One example is the collaboration around tools, resources, and professional development between iDEAL (Innovation in Digital Education and Leadership) Institute³² at Loyola Marymount University's School of Education and Catholic schools in the Diocese of Orange.

Dioceses have put together resources for their school principals and teachers. An interesting example is the Diocese of San Diego³³ which proposed a step-by-step approach to implement distance learning during school closures, considering first preparation, then connection and relationship building, and finally the establishment of routines and structures. Each step includes a number of specific actions that schools could implement. The Diocese also prepared a planning guide to help schools navigate the remainder of the 2019-2020 school year (San Diego and Imperial Valley Catholic Schools, 2020)³⁴. The guide is wide-ranging, considering not only educational delivery, but also communications, marketing and enrollment, budgets, tuition, em-

[online-class-public-schools.html?searchResultPosition=1.](#)

28 See <https://www.crpe.org/content/covid-19-school-closures>.

29 See https://www.ncea.org/NCEA/Learn/NCEA/Learn/NCEA_Virtual.aspx

30 See <https://www.ncea.org/catholicsschoolmatters>

31 See <https://www.arrupevirtual.org/>

32 See <https://soe.lmu.edu/centers/ideal/>

33 See <https://sites.google.com/view/sd-catholic/distance-learning>

34 See <https://docs.google.com/document/d/1617LJFdTHHSnHpErCsFwAw2c1fLz9zy7FDpiOdwqAzM/edit>

ployees, school support, family support, health and well-being, end-of-year events, accreditation, and activities planned for the summer of 2020. Finally, the Diocese provided links to materials available on the web that could be useful for TK-12 principals and teachers³⁵.

Still in terms of available resources, it is also interesting to note that the crisis has led many nonprofit organizations to organize their material in a more accessible way on their websites, which can also help for distance learning. As just one example, National Geographic curated its resources for K-12 learners on a landing page, with materials categorized by level (Grades K-2, Grades 3-5, and Grades 6-12)³⁶, as well as by topic. The nonprofit is also livestreaming content under its Explorer Classroom³⁷. Even for profit organizations have made resources available. As just one example, Google has a site with a few distance learning resources³⁸, including a course on distance learning for educators³⁹.

To conclude, overall in developed countries, while transitioning to distance learning will be challenging for many schools, teachers, and students, a wide range of resources are available to facilitate this transition, and the basic infrastructure in terms of connectivity to the internet is in place in most geographic areas. There are important risks for students from disadvantaged backgrounds to be left behind. These risks will need to be addressed, but the students are likely to come back to schools when they reopen instead of dropping out of, and remedial education at that time could be relied upon to ensure that they have acquired the knowledge and skills required to be able to succeed in the next school year. By and large, at least in comparison to risks in developing countries, Catholic and other types of schools should be able to respond to the immediate effects of school closures, including by providing distance learning options of good quality that will help mitigate losses in learning. There will be other losses, including for nutrition and wellbeing, but again for most children these may not be too severe in comparison to risks in

35 See https://docs.google.com/document/d/1I9bSYMv_Izv8Lo3gr7DnUCQ7rT-90Fa4Ck0o1G_O6DSg/edit

36 See <https://www.nationalgeographic.org/education/classroom-resources/learn-at-home/>

37 See <https://www.nationalgeographic.org/education/student-experiences/explorer-classroom/>

38 See https://edu.google.com/latest-news/covid-19-support-resources/?modal_active=none

39 See <https://skillshop.exceedlms.com/student/path/27925-distance-learning-for-educators>

the developing world. However, a specific risk for Catholic schools especially in the United States will be financial. Given massive unemployment, Catholic schools may become less affordable for segments of the population in countries where they do not receive much financial support from the state, with lower enrollment threatening sustainability, as will be discussed in the next section, but before that it may be useful to provide information on Catholic school responses to the immediate impacts of the crisis.

Catholic School Responses

In the above discussion, even though guidance on potential responses has been provided by Catholic school networks, many of these responses are not specific to Catholic school. Good practices for education systems in general typically also apply to Catholic schools. But are Catholic schools implementing some of these potential responses? In order to find out, consider first at the international level results from the short survey implemented with OIEC to inform a series of conference calls with representatives of national Catholic education associations that were held in early May 2020.

The survey was sent on April 28, 2020, and thus reflects information that was available to respondents at that time. At the time of writing, within a week, 171 responses were received from 31 countries. For some countries, multiple responses were received. In those cases, individual responses were weighted equally to obtain aggregate country-level responses. When multiple respondents from the same countries answered the survey, there was strong convergence in the responses provided, which is reassuring. Among the 31 countries, 10 are developed countries: Belgium, France, Greece, Italy, Malta, the Netherlands, Norway, the Republic of Ireland, the United Kingdom (more specifically England and Wales), and the United States. In the case of Belgium, responses were received for two Catholic school networks covering respectively the Francophone and Flemish parts of the country, hence statistics are computed for a total of 11 Catholic school networks among developed countries. The other countries for which responses were received are all developing or emerging countries/economies. Below, statistics are provided for developed and developing countries separately (in the companion paper on developing countries, the data for developing countries are disaggregated for African and other countries).

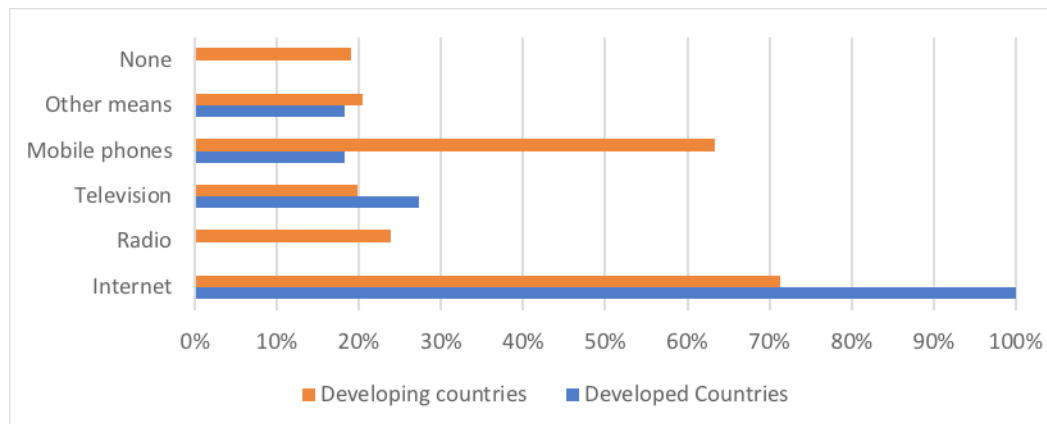
While only a minority of all countries with Catholic schools are represented in the survey, many of the countries with a large enrollment are included in the survey responses. As a result, the survey is illustrative of conditions for coun-

tries that account for 58.3 % of all students in Catholic schools globally in 2017 according to data from the latest statistical yearbook of the Church (Secretaria Status, 2019), and 58.0 % of all Catholic schools globally. Those percentages are slightly higher for secondary schools than primary schools and preschools, but all estimates are very similar to each other. For developed countries the shares are even slightly higher. For example, nine of the ten developed countries in the sample are members of the OECD (Malta is not). Enrollment in Catholic schools in these nine countries accounts for 63.8 % of total enrollment in high income OECD countries.

Apart from identifying information for respondents, in order for the survey to not represent a time burden for respondents at a time of stress, only six questions were asked – four closed form questions and two open ended questions. In particular, respondents were asked whether they had been able to implement distance learning solutions for students in their schools while the schools were closed. If so, respondents were asked to indicate the medium used, with the following options: Internet, Radio, Television, Mobile phones, Other means, or None. As shown in Figure 1, in developed countries all Catholic school networks have implemented distance learning solutions, while this is the case only for 4 out of 5 developing countries. Given a reliance on the internet, other media have not been used much in developed countries, while in developing countries, and especially Africa, mobile phones and radio have been used more. The proportion of countries relying on television programming is similar in developed and developing countries. What is concerning is that almost 1 in 5 Catholic school networks in developing countries (in Africa

Figure 1

Distance Learning Solutions by Medium, Multiple Countries (% of Countries)



Note. Source: Author, based on OIEC survey.

essentially) had not implemented any distance learning solutions by the time of the survey, versus none in developed countries.

For responses implemented in Europe specifically, useful collection of information has been undertaken with representatives from its members by the European Committee for Catholic Education (*Comité Européen pour l'Éducation Catholique in French* or CEEC). Key results will soon be published in the organization's newsletter⁴⁰. One interesting initiative in Belgium has been the implementation of a survey by the Francophone network to assess the readiness of schools and teachers to implement distance learning (Devel, 2020). The survey identifies among others the actions taken by schools to implement distance learning and the constraints faced by households to access distance learning, as well as the frequency of interactions between schools and teachers while schools have been closed.

For the United States, the survey mentioned earlier by Hanover Research (2020) provides details on selected responses implemented by private schools, including Catholic schools, to mitigate the immediate impacts of school closures. As differences between private and Catholic schools in responses are small, only the general conclusions from the survey need to be mentioned since they also apply to Catholic schools. Schools have moved to online learning aligned with the curriculum. This was probably a major undertaking for many schools because before the crisis, half of the respondents stated that their school did not have experience with online learning, and another quarter mentioned that they had offered online learning only a few times a year. Many schools are also keeping in close contact with parents, with half of the schools contacting parents several times a week, and a third every day. Most teachers have been continuing to work full time, focusing on online learning, but some have been teaching part time. Two thirds of the schools are providing support for students with special needs.

Many schools have also provided devices such as tablets for students who needed them to facilitate online learning, as well as professional development for teachers focusing on teaching online. In some cases, schools have also helped families to get access to the internet. Catholic schools have been more proactive in this area – they have the highest rate of providing devices for students. The survey also shows that most common applications used for online learning include Zoom, Google Classroom, Khan Academy, Facebook Live, BrainPop, and Blackboard. Finally, one fourth of Catholic schools have provided meals for students, the highest proportion in the sample by types of schools.

40 See <http://www.ceec.be/>

Short and Medium Term Impacts from the Crisis

Risks from the Crisis

While school closures represent an immediate challenge for all schools and not solely for Catholic schools, the economic crisis generated by the pandemic is a major threat specifically for private schools, and in particular for Catholic schools, at least in countries where affordability issues have contributed to a downward trend for enrollment in Catholic schools. The United States is a case in point. In the mid-1960s, 5.2 million students were enrolled in Catholic elementary, middle, and high schools in the United States. Today, the estimate is at 1.8 million. Each year some Catholic schools are forced to close, but even some of those that manage to remain open are often under financial strain.

Several factors may have contributed to the long-term decline in enrollment in Catholic schools in the United States, but lack of affordability is clearly one of them (Murnane & Reardon, 2018; Wodon, 2017, in press-b; see also Wodon, in press-a, for a comparison with the United Kingdom and Ireland; on the broader characteristics of private schools in the United States, including Catholic schools, see among others Glander, 2017, Broughman et al., 2019, and McFarlan et al., 2019). As the COVID-19 crisis leads many parents to lose their jobs, tuition costs for Catholic schools may become out of reach, leading to a further decline in enrollment, possibly as early as in the next school year. In developing countries, many students may drop out of school due to the crisis. In developed countries, the likely scenario is for some students to shift from Catholic schools to public schools, which are tuition free while Catholic schools are often not. To show how Catholic schools in the United States are particularly vulnerable to such shifts, this section discusses factors affecting affordability of Catholic schools in the United States in comparative perspective, using other OECD countries as comparators. Next, the section discusses how recessions have affected enrollment in Catholic schools in the United States over the last few decades. Finally, potential responses are considered in terms of both what Catholic schools may need to do, and the type of relief that they may be eligible to receive under legislation adopted to respond to the crisis.

Whether Catholic schools are affordable for parents who are willing to consider those schools for their children depends on the level of out-of-pocket cost for enrolling in the schools in comparison to out-of-pocket costs for other types of schools, and the level of earnings of parents. Without

conducting a detailed affordability analysis in this paper, in the context of the current crisis, two simple indicators can be used to show that in comparison to other OECD countries⁴¹, Catholic schools in the United States are likely to be less protected from the COVID-19 economic downturn. This, in turn, matters for the future of Catholic K12 education in developing countries as a whole because despite 50 years of decline in enrollment, the United States remains today (within OECD countries) one of the two countries with the largest enrollment in Catholic schools, the other country with similar enrollment being France.

Table 2 provides data related to the exposure of Catholic schools to the economic crisis caused by COVID-19. Two criteria related to protection against affordability risks are used to suggest the degree of exposure to downturns by country. The first column in Table 2 is based on data from the OECD Education at a Glance reports (OECD, 2017b)⁴². It provides the ratio of public funding for private and public schools, as a proxy for the share of the cost of private schools paid for by the state, using data for 2014. Assume that operating costs for Catholic and public schools are broadly similar (in the United States, Catholic schools operate at a slightly lower cost than public schools⁴³), so that tuition fees would also likely be similar if parents were to pay the full operating costs. Assume further that public funding for Catholic schools in any given country is similar to public funding for other types of (non-profit) private schools. Under these assumptions, the ratio of public funding for private and public schools should be a relatively good proxy for the share of the cost of Catholic schools paid for by the state (see Wodon, 2019a, for a discussion). When a larger share of the tuition costs for private and thus possibly Catholic schools are subsidized by the state, the affordability risk during an economic downturn is lower.

41 The OECD has 36 member countries. In the 2017 Education at a Glance background tables, data on public spending for public and private schools are however missing for Greece, and for Germany and Japan, estimates are only available for all schools combined, while for Switzerland data are only available for public schools. This means that for those countries, the ratio of public funding for private in comparison to public schools is not computed.

42 The analysis is based on data on public spending for public and private schools from the OECD Education at a Glance report for 2017 (with the data corresponding to calendar year 2014). The estimates of public spending for public and private schools are available in one of the background tables on the web that accompany the report.

43 The largest operating cost for schools is the salaries of teachers. NCEA estimates that teacher salaries in Catholic elementary schools are at 82 percent of the level observed for local public schools districts (NCEA, 2017). For secondary schools, salaries in Catholic schools are at 85 percent of the level in public schools.

In Table 2, the United States has one of the lowest rates of subsidization for private schools among OECD countries, suggesting that parents must pay the bulk of the cost of enrolling their child in private, including Catholic, schools. This is confirmed by data from NCEA (2017) which suggests that the share of the operating income of Catholic schools provided by state governments is even lower than suggested in Table 1, at 3.6 percent for elementary schools, and 2.1 percent for secondary schools. The even lower level of subsidization for Catholic as opposed to private school stems in part from the fact that the country's Constitution puts strict limits on public funding for faith entities at the federal level.

The second column in Table 2 is a measure of risks for parents of becoming unemployed due to lack of protection for workers in the countries' laws. This is an imperfect measure for assessing potential job losses related to economic crises, but it is nevertheless instructive. The OECD calculates four different indices related to (1) Protection of permanent workers against individual and collective dismissals; (2) Protection of permanent workers against (individual) dismissal; (3) Specific requirements for collective dismissal; and (4) Regulation on temporary forms of employment. For simplicity, the average value for the four indices is provided in Table 2 (the ranking of countries, and especially the position of the United States, is not too sensitive to the use of each particular ranking as opposed to the overall average). The data are for 2013. Clearly, workers in the United States tend to lack employment protections in comparison to other countries. The fact that workers in the United States are especially vulnerable to the COVID-19 crisis is also illustrated by the different approach used so far in the United States and in European countries to respond to the crisis. Many European countries have provided subsidies to firms to keep workers on their payroll. By contrast, in the United States, social protection responses to the crisis have focused on extending unemployment benefits and providing cash to households, leading to a larger number of jobs lost, which may have negative consequences for the future.

Finally, the last column in Table 2 provides estimates of total enrollment in Catholic primary and secondary schools by country based on data from the annual statistical yearbooks of the Church (*Secretaria Status*, 2018). The data are for 2016. France and the United States are the two countries with the largest enrollment (1.8 million students each), followed by Spain, Belgium, and Mexico (at slightly above or below one million). Ireland, Australia, Canada, the United Kingdom, and Chile also have substantial enrollment, well above half a million students. Overall, despite losses in enrollment over

Table 2

Enrollment in Catholic Schools and Indicators of Affordability During the COVID-19 Crisis

	Ratio of public funding for private versus public schools (%)	Average index of legal protection for workers	Children enrolled in Catholic primary and secondary schools (thousands)
Australia	71.4	1.86	751
Austria	55.3	2.49	72
Belgium	84.2	3.17	974
Canada	26.4	1.40	708
Chile	62.6	1.69	583
Czech Republic	78.8	2.45	15
Denmark	91.2	2.27	10
Estonia	71.1	2.43	0
Finland	101.8	2.01	0
France	53.3	3.14	1,795
Germany	NA	2.69	317
Greece	NA	2.66	6
Hungary	146.0	2.29	90
Iceland	90.1	2.32	0
Ireland	50.3	2.07	836
Israel	198.2	2.01	47
Italy	13.6	2.97	249
Japan	NA	2.05	88
Korea	42.2	2.22	44
Latvia	124.2	2.75	0
Lithuania	64.2	2.71	97
Luxembourg	28.5	3.18	5
Mexico	1.1	2.80	918
Netherlands	41.0	2.53	0
New Zealand	30.5	0.83	36
Norway	77.4	2.61	1
Poland	87.8	2.45	132
Portugal	22.7	2.48	57
Slovak Republic	94.3	2.46	35
Slovenia	87.9	2.47	1
Spain	47.7	2.71	1,079
Sweden	98.3	2.18	1
Switzerland	NA	2.15	6
Turkey	0.0	3.03	3
United Kingdom	72.3	1.48	715
United States	9.4	1.22	1,764

Note. Source: Compiled by the author from OECD data and the statistical yearbook of the Catholic Church.

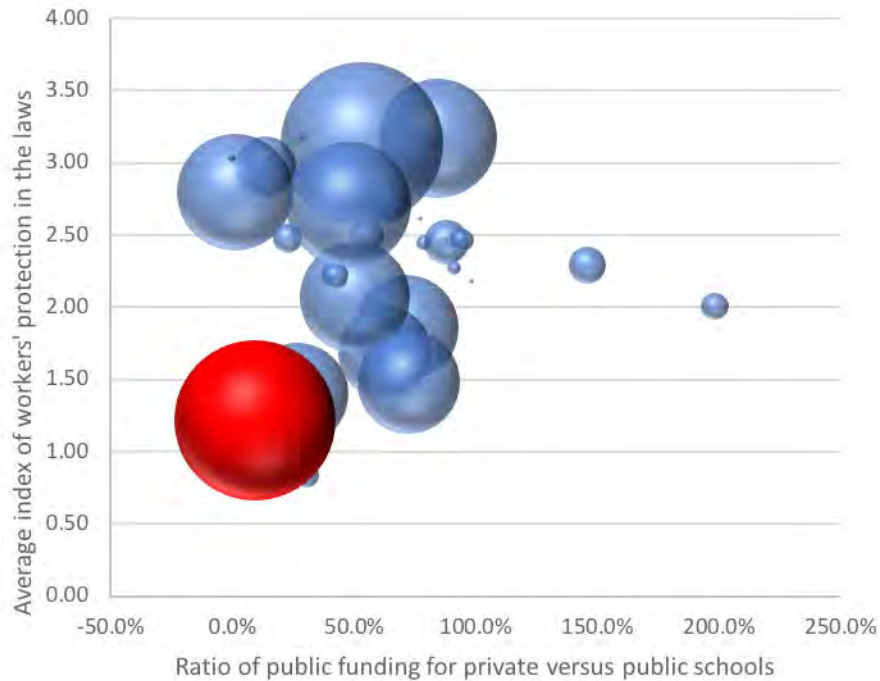
the last 50 years, the United States still accounted for 15.4 % of total enrollment in Catholic schools in all 36 countries in 2016. The position of Catholic schools according to the two indicators of affordability (subsidization of private schools and worker protections in the countries' laws) is stronger in all the other countries with large enrollment in Catholic schools than in the United States. The brunt of the impact of the crisis on enrollment in Catholic schools in OECD countries is thus likely to be observed in the United States. Hence responses in the country will matter for overall enrollment in the West.

Figure 2 provides a visualization of the data in Table 2. The ratio of public funding for private versus public schools is represented on the horizontal axis, while the average index of workers' protection in the countries' laws is on the vertical axis. The size of the data points in the Figure is proportional to total enrollment in Catholic primary and secondary schools. Note that the vertical axis crosses the horizontal axis at a negative value of $-.5$ for better visualization, even though none of the values for the implicit rate of subsidization are negative. In countries located towards the upper right of the Figure, Catholic schools are better protected against affordability risks during downturns. The United States is identified in the scatter plot through the red dot. It is located in the bottom left of the Figure, suggesting substantially less protection against affordability risks for Catholic schools, and thereby higher vulnerability of enrollment in Catholic schools in comparison to other OECD countries. Of note, in the United States as well as in some European countries, as enrollment has declined, the average size of Catholic schools has also declined (Wodon, 2019b). This has reduce the ability of the schools to absorb further reductions in enrollment given the fixed costs of running schools.

How large could the drop in enrollment be in Catholic schools in the United States due to the COVID-19 crisis? This is a difficult question to answer since how the crisis will evolve is not known, but insights can be gained from previous recessions. During the great recession, enrollment in private schools dropped significantly, and has still not recovered according to the latest data available. This drop however may include the long term trend towards a decline in enrollment in Catholic schools which account for a large share of all private schools. Another factor leading to declines in enrollment is simply the fact that the number of births in the United States has declined by about one eighth in the last dozen years, which has led to smaller cohorts of children entering primary school in recent years.

Figure 2

Indicators of Protection from Affordability Risks for Catholic Schools During Economic Crises, OECD Countries



Note. Source: Author, based on data from Table 2 (United States identified in red).

To explore a bit more systematically the potential impact of recessions on enrollment in Catholic schools, Figure 3 displays estimates of enrollment growth in in Catholic primary and secondary schools in the United States since 1995 using a two-year moving average to smooth the data a little bit. The Figure also displays the growth rate in GDP per capita in the United States two years earlier, again using a two-year moving average. For GDP growth, values two years earlier are used because when an economic crisis hits, parents need to wait at least for the end of the school year to potentially shift their child(ren) to a public school if their Catholic school is not affordable for them anymore. In addition, some parents may try to delay such a shift even if they have difficulties in paying the tuition, for example to enable a child to complete a cycle (elementary, middle, or high school) at his or her current school. In other words, while some of the impact of an economic

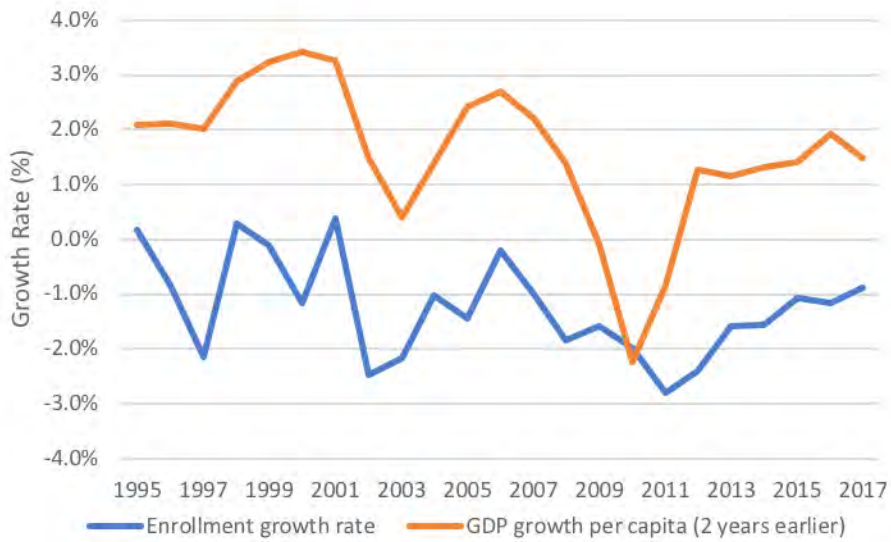
crisis on enrollment in Catholic schools may be observed as soon as the next school year, part of the impact may be delayed by one or even several years.

On average, the growth rate in enrollment in Catholic schools for the years displayed in Figure 3 is negative, reflecting the long-term decline in enrollment which started in the 1960s. The average growth rate in GDP per capita is by contrast positive, but with a dip in 2003 when economic growth was weak, and negative values for the period from 2009 to 2011 which corresponds to the great recession. There is a clear, albeit imperfect relationship between the two growth rates. When an economic crisis hits, enrollment in Catholic schools drops more. When the economy does well, enrollment may still drop, but by a smaller share, and when growth is especially strong, enrollment growth may even be positive.

This relationship is visualized in Figure 4 through a scatter plot for the estimates provided in Figure 3 and a trendline. The trendline suggests that a substantial share of the variation in enrollment growth could possibly be accounted for by the variation in GDP per capita growth according to the simple linear regression displayed in the Figure. This admittedly very basic analysis suggests that starting from a base of minus two percentage points per year under zero growth, each point of GDP growth may reduce the long-term drop in enrollment by about half a percentage point. This estimate should not be taken too seriously, as it would need to be confirmed by detailed econometric work, but it does make intuitive sense. Preliminary findings from an analysis by Lamb and Mbekeani (2017) suggest the possibility of a much larger decline in private school enrollment during the great recession.

If, as expected at the time of writing this paper, the recession generated by the COVID-19 pandemic in the United States is severe, the drop in enrollment for Catholic schools may also be severe, and indeed substantially more severe than what was observed during the great recession. This drop in enrollment may be accentuated by the fact that job losses have been staggering. In just five weeks, from mid-March to the end of April 2020, more than 33 million workers applied for unemployment benefits. This level of claims is an order of magnitude larger than the highest values previously recorded. It is also a much larger negative impact in a short time than the total number of jobs lost during the three years great recession, and it does not take into account workers who may have lost their job but did not qualify for unemployment benefits, or workers who may have tried to apply for unemployment benefits but were not able to do so because state systems to register such claims have been overwhelmed. The unemployment rate reached 14.7%

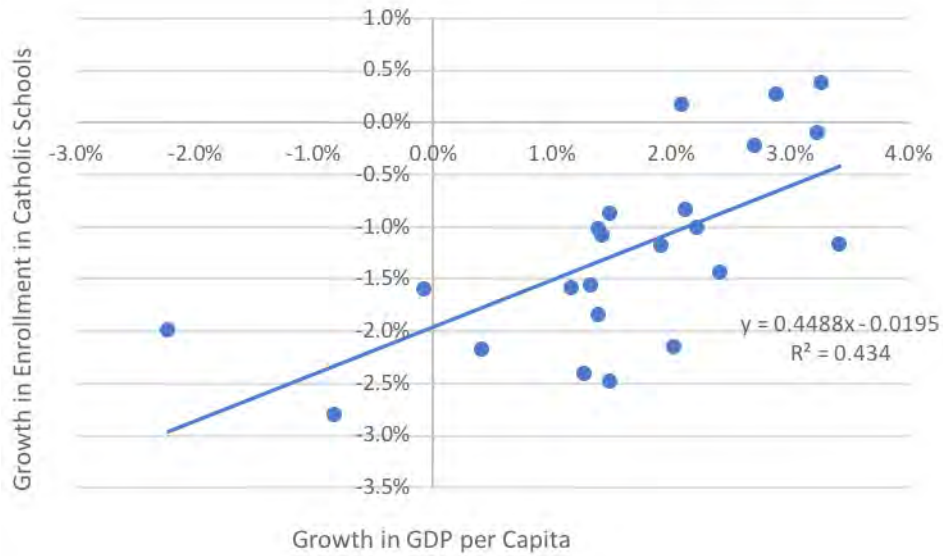
Figure 3



Note. Source: Author, based on data on GDP growth and enrollment growth.

Figure 4

Relationship between GDP Per Capita Growth and Growth in Enrollment in Catholic Schools in the United States



Note. Source: Author, based on data on GDP growth and enrollment growth.

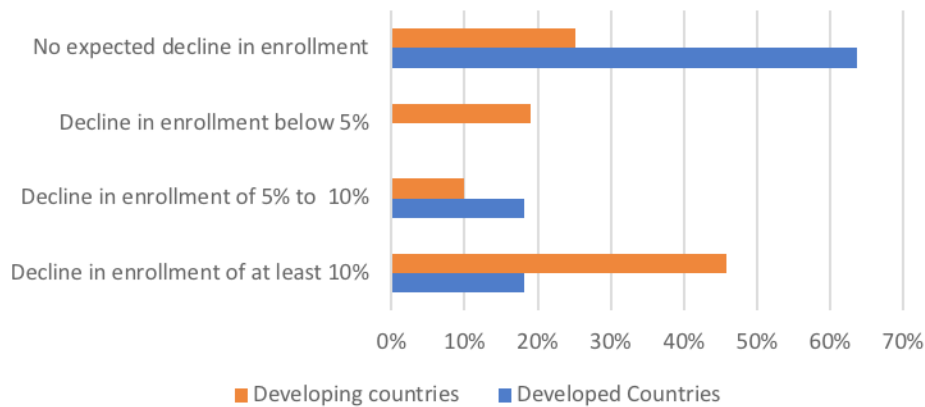
in April 2020, its highest level since the great depression. Finally, the share of the adult population that is employed (thus factoring also losses in employment due to individuals leaving the labor force) also fell to its lowest level in decades. While there may be a rebound when the economy reopens, lasting damage will have been done. In conversations with Catholic school leaders, drops in enrollment well above 10% have been commonly mentioned. The fact that the crisis hit households in March-April may also be particularly damaging for Catholic schools because this can be when decisions for enrollment in the next school year are made.

Insights on the risks faced by Catholic schools not only in the United States, but also in other developed countries can also be obtained from the OIEC survey mentioned earlier. Respondents were asked if they believed that the COVID-19 and related economic crisis would affect enrollment of students in the next school year. Potential responses were: Yes, with a large decline in enrollment of at least 10%; Yes, with a decline in enrollment of 5% to 10%; Yes, but with a small decline in enrollment below 5%; and No, no decline in enrollment is expected. As shown in Figure 5, just under a fifth of Catholic school networks in developed countries expect a drop in enrollment of at least 10% (this includes the United States), and a similar proportion expect enrollment to drop by 5% to 10%. Yet almost two thirds of the Catholic school networks in developed countries expect no decrease in enrollment at all, which relates to the fact that in many of the countries included in the analysis, tuition costs for enrollment in Catholic schools are paid for by the state. The situation is worse in developing countries, where only one in four Catholic school networks do not expect any decline in enrollment. This is probably due in part to the fact that a smaller proportion of the school networks are funded by states, but also to the risk that many children may simply drop out of schools if parents cannot afford anymore the out-of-pocket and opportunity costs of schooling for their children.

Finally, for the United States, information on short and medium term risks related to the crisis is also available in the survey by Hanover Research (2020) mentioned earlier. As was done before for immediate risks, Table 3 provides comparative statistics for all schools and for Catholic schools on the share of respondents perceiving various short and medium term risks as extremely worrying, very worrying, moderately worrying, slightly worrying, and not worrying at all. The risks are ranked again according to the share of respondents extremely or very worried in the overall sample. For the overall sample, the top two worries are related to students' families struggling finan-

Figure 5

Expected Decline in Enrollment, Multiple Countries (% of Countries)



Source: Author, based on OIEC survey.

cially and losing enrollment next school year. The next three worries concern drops in philanthropic support, the risk that the crisis may last into the next school year, and the fact that teachers may be struggling financially.

Two additional important findings emerge from the data. First, the share of respondents who are extremely or very worried are often higher for short and medium term risks than was the case for the immediate risks discussed in the previous section. Second, for the risks in Table 3, in many cases a higher share of respondents working for Catholic schools tend to be extremely or very worried than is the case for the whole sample, which implies that if comparisons were provided between Catholic and other schools, the differences would be even larger⁴⁴. In particular, 66 % of respondents from Catholic schools are extremely or very worried about students' families struggling financially, and the proportion is 56 % for losing enrollment in the next school year. Given that the schools are dependent on tuition for their operations this does not bode well for the ability of some schools to remain open. Raising more charitable donations to cover financial shortfalls will be hard, given that 51 % of respondents from Catholic schools also expect a drop in philanthropic support.

44 Readers can compute approximate statistics for non-Catholic schools as follows. Define by SC the share of respondents perceiving a risk at a certain level among Catholic schools, by SNC the same share for non-Catholic schools, and by SO the share in the overall sample. Since 61 percent of respondents are from Catholic schools, we have $SO = SC \times 0.69 + SNC \times 0.31$, so that $SNC = (SO - SC \times 0.61)/0.31$. Given that sample sizes may differ between responses to different questions, those statistics, which are not in the original report, are not provided here.

Table 3

Perceptions of Selected Short/Medium Term Risks, Private Schools, United States (%)

	Extremely worried	Very worried	Moderately worried	Slightly worried	Not at all worried
All private schools					
Students' families struggling financially	27	38	26	9	0
Losing enrollment next school year	24	27	24	18	7
Drops in philanthropic support	17	27	24	22	9
Crisis lasting into next school year	17	25	30	22	7
Teachers struggling financially	11	17	26	26	19
Catholic schools					
Students' families struggling financially	28	38	26	7	0
Losing enrollment next school year	26	30	22	17	5
Drops in philanthropic support	21	30	24	20	5
Crisis lasting into next school year	17	28	31	21	4
Teachers struggling financially	10	17	25	29	18

Note. Source: Hanover Research (2020).

There is no magic bullet to protect Catholic schools from the economic crisis affecting the United States as well as other countries. But some general considerations can be shared, first in terms of the support that state and federal policies may provide, and next in terms of what Catholic schools themselves could do to maintain their comparative advantage and stem the decline in enrollment. Again, the discussion focuses on the United States where Catholic schools are especially at risk.

Consider first potential relief under federal and state policies. Catholic and other private schools may be able to apply for relief from the Education Stabilization Fund, funded at \$30.75 billion, which is part of the \$2 trillion CARES Act passed by Congress and signed by the President. The Education Stabilization Fund will allocate \$13.5 billion in grants to states for K-12 schools, with private schools eligible for funding. It also includes \$3 billion for governors to provide emergency support to schools, and \$14.2 billion for higher education. In addition, Catholic and other private schools may be able to apply for the Paycheck Protection Program from the Small Business

Administration for loans. They may also be able to benefit from Economic Injury Disaster Loans of up to \$10,000. For these and other programs, Catholic schools should consult Diocesan attorneys to check on eligibility, but the programs are likely to provide at least some level of relief to some of the schools. In addition, provisions of the CARES Act relating to protections for individuals also apply to those working in Catholic and other private schools who may be furloughed or lose their job⁴⁵.

In past recessions, public funding for schools has typically declined, as state and federal budgets have been stretched to respond to other needs. In the United States, funding for education was cut during the great recession with negative impacts especially for disadvantaged students (Jackson et al., 2018). In such contexts, the argument to support private (nonprofit) schools may be hard to make. Yet it is important to support nonprofit private schools during downturns because of the savings they generate for public budgets since parents pay most of the tuition costs for their children.

In the United States, based on a simple average cost per pupil in public schools and the number of children enrolled in Catholic schools, the National Catholic Education Association suggests on its website that Catholic schools provide US\$ 21 billion in budget savings per year. Using data from the OECD on public spending for public and private school, estimates for the United States in Wodon (2019a) are similar, at US\$ 19 billion. For 38 OECD and partner countries, budget savings from Catholic schools are valued at \$63 billion in purchasing power parity, and for all private schools, the savings are much larger (Wodon, 2019c). Catholic schools also contribute substantially through education to human capital wealth (Wodon, 2019d). Preventing a collapse of private schools during the current crisis is in the interest of local, state, and federal budgets in the medium term, since the cost of public schools would increase if a large number of students were to shift from private to public schools because of the crisis.

While eligibility for relief under the CARES Act is good news for Catholic and other private schools, it will not be sufficient. If tuition revenues fall significantly due to enrollment losses, in order to balance their budget, the schools will need to raise funds from donors, which will be hard in the current context, or cut costs. A first step for Catholic schools is to understand exactly where they stand in terms of tuition and other revenues, expenditures, and cash flow. Schools need to assess how much additional income they may

45 See https://www.ncea.org/NCEA/Proclaim/News/Press_Releases/Update_on_CARES_Act_Provisions_and_Catholic_Schools.aspx

be able to generate from donors, including parents as well as their parish or broader community. Detailed financial projections should be undertaken for the next school year with various scenarios in terms of enrollment, so that if expenditures must be reduced, options to do so are identified. Schools may need to furlough some employees. Layoffs may also in some cases be inevitable. In those cases, transparent communications to the school community, including teachers, other staff, and parents is essential. If employees must be furloughed or laid off, explaining clearly options for relief under the CARES Act is essential. If schools do not have clarity as to the expected level of enrollment and tuition revenues for the next school year, the timing of contract renewals may need to be delayed.

None of these steps are easy to take, but as noted in a useful open letter to independent school leaders letter⁴⁶ by Scafidi and Wearne (2020), schools need to plan for adverse outcomes, including in terms of public health safety. They must answer tough questions⁴⁷. How can schools credibly convince their community that they will provide safety against the coronavirus? What will be the school's crisis management plan when teachers, staff, or students tests positive for the coronavirus? How can schools manage tuition payments for example for parents facing only a one year liquidity problem? Do schools need to implement a temporary reduction in compensation for the next academic year? How can schools make their work environment better for teachers and staff when they and their children may be going back and forth between schools and home environments if school closures become intermittent. And finally, how can schools best educate their students under such potential back and forth?

Answers to these questions depend on local circumstances, given public health risks of reopening schools. In the United States, policy on school closures is under the authority of states (or even local jurisdictions) and not the federal government, hence different states or municipalities may have different approaches. In many other OECD countries, national policies may apply. In France, the government announced plans to reopen schools on May 11 over a three-week period, with different grades reopening at different times. In-person classes would have a maximum of 15 students (10 for younger groups) and a sanitation protocol would be followed by schools. At any given

46 See <https://coles.kennesaw.edu/education-economics-center/docs/Open-Letter-to-Independent-School-Leaders.pdf>

47 The questions have been slightly rephrased for the letter by Scafidi and Wearne (2020).

time, four different instruction modalities may be in place. Some students may be physically in classrooms, while others are engaged in distance learning under the supervision of teachers. A third group may be working by themselves on tasks and projects assigned by teachers, and a fourth group may be engaged in other activities, for example sports, cultural activities, or health activities organized with local authorities, with flexibility for local authorities to implement these broad guidelines based on local conditions. These broad guidelines would apply to public, Catholic, and other private schools alike.

Catholic School Responses

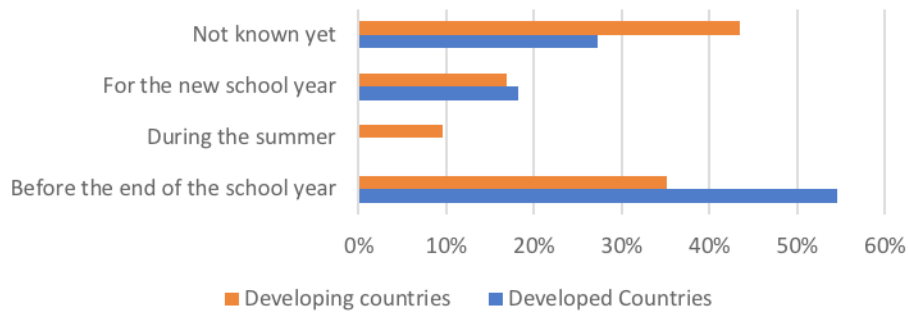
How are Catholic schools responding to the various short and medium-term challenges posed by the crisis? While the OIEC survey does not ask direct questions related to responses aiming at ensuring the financial sustainability of schools, two questions are of interest. The first relates to the timing for reopening the schools, and the second relates to activities planned to reduce losses in student learning.

Consider first when Catholic schools may reopen. This is a complex issue, with guidance provided by several organizations, including UNESCO and other international development organizations (UNESCO et al., 2020), national agencies such as the Center for Disease Control (2020) in the United States, and various think tanks, for example the American Enterprise Institute in the United States (Bailey & Hess, 2020)⁴⁸. The potential responses in the survey were: Before the end of the school year; Over the summer (for summer school); For the next school year; and Not known yet. As shown in Figure 6, more than half of the Catholic school networks in developed countries expect to reopen before the end of the school year, versus about a third for networks in developing and emerging economies. Correspondingly, the values for the other categories are lower among developed countries than among developing countries, but in both cases a substantial share of Catholic school networks do not yet know when they will be able to reopen. Note as mentioned earlier that in several countries, including the United States but also Germany as another example, the decision to reopen schools is made at the state level, and not at the national or federal level. In any case, Catholic school networks normally must follow the rules set for all schools in the countries where they operate.

48 See <https://www.aei.org/wp-content/uploads/2020/05/A-Blueprint-for-Back-to-School.pdf>

Figure 6

Timing for Reopening Schools, Multiple Countries (% of Countries)



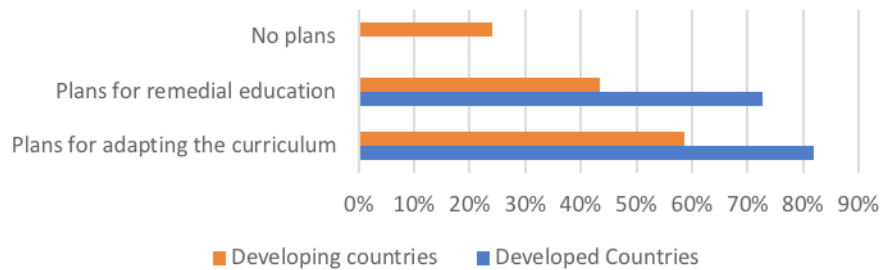
Note. Source: Author, based on OIEC survey.

Consider next how Catholic school networks are planning to respond to the challenges represented by loss of learning for children when they return to school. Respondents in the survey could indicate whether their school network is planning to adapt the curriculum and/or provide remedial education, or whether none of these actions were being considered at the time of the survey. As shown in Figure 7, the share of networks in developed countries planning to adapt their curriculum and provide remedial education are much higher than is the case for developing countries, where more than one in five school networks have not yet considered those two options. These differences are not surprising given that the capacity to adapt the curriculum and provide remedial education may be lacking in some developing countries, especially in sub-Saharan Africa, in part due to lack of financial resources.

On the financial side, what are the primary needs of Catholic schools? Insights are available from the Hanover Research survey for the United States. The survey asked respondents about what needs their school would have that could use philanthropic support. Respondents in the overall sample ranked the potential responses as follows (by order of priority): Financial support for students and their families; financial support for the school; ensuring all students have access to technology (e.g., tablets, Chromebooks); financial support for teachers and other school staff; ensuring all students have internet access; and ensuring students have enough food. The rankings for Catholic schools were broadly similar, but the first two priorities were financial support for the school and financial support for teachers and other school staff, reflecting the stronger pressure that the schools are feeling from potential

Figure 7

Curriculum Adaptation and Remedial Education, Multiple Countries (% of Countries)



Note. Source: Author, based on OIEC survey.

losses in enrollment and tuition in comparison to other private schools. This pressure may however not apply to many other Catholic school networks in developed countries since, as noted in Figure 5, many of these networks do not expect to lose students, a very different context in comparison to the United States.

Finally, one other useful question in the Hanover Research survey is the requests that Catholic and other private schools would have for the Governor of their state or the Mayor of their city. Here, rankings are the same for respondents from Catholic schools and the overall sample. The priority is to get clear guidance about what is expected of schools during the COVID-19 pandemic. Next is the possibility of providing internet access for students, followed by the possibility to offer professional development for teachers around online learning. Providing meals for students and their families was last. Note that private schools do not get state funding for the most part, so this is not a request.

To sum up, particularly in the United States, among all private schools Catholic schools are under particular pressure due to the pandemic in terms of enrollment losses. It should be recognized though that the enrollment challenge runs deep, and in some ways, this challenge is only exacerbated by the crisis. As mentioned earlier, in the United States but also in a number of other OECD countries, enrollment in Catholic schools has declined for some time, or at best remained flat. This points to a loss in comparative advantage. In the United States, apart from the issue of affordability, Catholic schools may have suffered from competition from charter schools in urban areas, the weakening of the social fabric of many communities and disaffection from religious organization (Smith et al., 2015), and the sexual abuse

crisis that has affected the Catholic Church specifically. But they may also not have responded sufficiently to parental priorities about what their children learn in school.

As discussed in Wodon (in press-b) in another issue of the *Journal of Catholic Education*, a recent market research survey implemented by NCEA to assess perceptions regarding Catholic schools suggests that many parents have a favorable perception of Catholic schools. Yet despite positive perceptions, many also do not consider the schools as the right option for their child. This is due not only to cost, but also to the perception that the schools place too much emphasis on religious instruction to the detriment of academics. Parents fear that this may put their child at a disadvantage when applying for college or when looking for employment (NCEA & FADICA, 2018). As to the issue of cost, it is exacerbated by a lack of knowledge about assistance programs especially at the state level that can provide tuition assistance. If Catholic schools are aiming to maintain their enrollment even beyond the current crisis, they may need to discuss in some depth options that would enable them to maintain their comparative advantage in an increasingly competitive and constrained education market without sacrificing their core values.

Conclusion

Catholic schools face both immediate and short to medium term challenges due to the COVID-19 crisis. School closures are threatening the ability of students to learn and may also have other negative effects, especially for children from disadvantaged backgrounds. In addition, at least in the United States, Catholic schools are under financial stress as the economic crisis may lead to a substantial drop in enrollment. While the schools in most countries may be able to respond to the challenges generated by temporary school closures among others through distance learning options, their ability to maintain enrollment is less clear, again at least in the United States. In many ways, the current crisis is exacerbating difficulties that the schools in the country have faced for some time, since enrollment has been declining since the mid-1960s. In many other developed countries, risks for the financial sustainability of Catholic schools are less severe.

How Catholic schools respond to the twin challenges of ensuring learning during school closures and beyond, and remaining not only affordable but also relevant for families at a time of economic stress, may affect whether they are able to maintain their comparative advantage in the future. This may

require an assessment of some of the trade-offs that schools face in terms of the balance between the various aspects of the education they provide.

It is too early (at the time of writing) to assess how adequate Catholic school responses as well as broader national policy responses will be to mitigate the effects of the current crisis – not only in education, but also in health and nutrition, and in social protection and labor markets. For developing country contexts, a useful review of options for education systems to cope with the current crisis is provided in World Bank (2020g). Some of the lessons from that review are valid for developed countries as well, even if some of the challenges are different. That review also emphasizes the idea of rebuilding schools better after the crisis, for example through blended learning mixing in-person teaching with online materials. While building better will not be easy, it does help to keep hope in this possibility.

There is still a bit of time for Catholic schools to think about the best options to meet their current challenges before the start of the new school year. In this paper, a unique asset that Catholic schools may be able to rely upon, namely a shared faith with their community, has not been discussed in the context of the current crisis – but this could be a topic of focus for future important work. Another topic for further research would be how to use the challenges of the current crisis to rebuild better – to strengthen Catholic schools. This will not be easy, but this perspective can help for motivation.

While this paper has explored some of the likely impacts of the crisis on Catholic schools and potential responses with a focus on developed countries, and especially the United States, a companion paper in this issue of the journal considers the case of developing countries, with a focus on sub-Saharan Africa. There is currently a flurry of papers and notes being written about the impact of the crisis on education systems and students by a wide range of authors and organizations, but few consider impacts on Catholic schools and their students despite the fact that the Catholic Church maintains one of the largest networks of schools in the World (Wodon, 2018). This is why it is hoped that this paper and the companion piece on developing countries will be of interest to readers of this journal. The analysis in both papers however remains preliminary and tentative. Both papers were prepared under tight deadlines to be made available quickly through the journal. This means that some key resources or insights may have been overlooked. Even more importantly, much is still unknown on how the crisis will evolve, and what this may entail for the Catholic schools response. Still, hopefully this preliminary and tentative analysis will be useful for Catholic school teachers and leaders in these difficult times.

References

- Alexander, K. L., Entwisle, D. R., & Olson, L. S. (2007). Lasting consequences of the summer learning gap. *American Sociological Review*, 72(2), 167-180.
- Bailey, J., & Hess, F. M. (2020). A blueprint for back to school. Washington, DC: American Enterprise Institute.
- Brinig, M. F., & M. S. Garnett. (2014). *Lost classroom, lost community: Catholic schools' importance in urban America*. Chicago: The University of Chicago Press.
- Broughman, S.P., Kincel, B., & Peterson, J. (2019). Characteristics of private schools in the United States: Results from the 2017-18 private school universe survey first look (NCES 2019-071). U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Centers for Disease Control. (2020). Interim guidance for administrators of US K-12 schools and child care programs to plan, prepare, and respond to coronavirus disease 2019 (COVID-19). Washington, DC: Center for Disease Control.
- CIDRAP. (2020). COVID-19: The CIDRAP viewpoint. Twin Cities, MN: University of Minnesota.
- Cooper, H., Nye, , Charlton, K., Lindsay, J., & Greathouse, S. (1996). The effects of summer vacation on achievement test scores: A narrative and meta-analytic review. *Review of Educational Research*, 66(3), 227-268.
- Devel, E. (2020). Enquête : De nouvelles pratiques (presque) partout. *Entrées libres*, 148, 8-9.
- Di Domenico, L., Pullano, G., Sabbatini, C. E., Boëlle, P. Y., & Colizza, V. (2020). Expected impact of reopening schools after lockdown on COVID-19 epidemic in Île-de-France. Report #10. Paris: Epicx-Lab.
- European Commission. (2020). European economic forecast, Spring 2020. Institutional Paper 125. Brussels: European Commission.
- Freeman, K. J., & Berends, M. (2016). The Catholic school advantage in a changing social landscape: Consistency or increasing fragility?. *Journal of School Choice*, 10(1): 22-47.
- Gershenson, S. (2013). Do summer time-use gaps vary by socioeconomic status? *American Educational Research Journal*, 50(6), 1219-1248.
- Glander, M. (2017). Selected statistics from the public elementary and secondary education universe: School year 2015-16 (NCES 2018-052). U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Green, B., Sikkema, D. , & Sikkink, D. (2018a). Cardus Education Survey 2018: British Columbia Bulletin, Ottawa: Cardus.
- Green, B., Sikkema, D. , & Sikkink, D. (2018b). Cardus Education Survey 2018: Ontario Bulletin, Ottawa: Cardus.
- Hallinan, M. T., & Kubitschek, W. N.. (2013). School sector, school poverty, and the Catholic school advantage, *Journal of Catholic Education*, 14(2), 498-518.
- Hanover Research. (2020). Private school COVID-19 response survey prepared for EdChoice. Arlington, VA: Hanover Research.
- HundrED. (2020). *Spotlight: Quality education for all during Covid-19 crisis*. Helsinki: Hundred.
- International Monetary Fund. (2020). *World economic outlook: April 2020*. Washington, DC: International Monetary Fund.

- Jackson, C. K., Wigger, C., & Xiong, H. (2018). Do school spending cuts matter? Evidence from the Great Recession. National Bureau of Economic Research Working Paper No. w24203, Boston: NBER.
- Jepsen, C. (2003). The effectiveness of Catholic primary schooling, *Journal of Human Resources*, 38, 928-941.
- Jones, T. C., Mühlemann, B. Veith, T., Zuchowski, M., Hofmann, J., Stein, A. Edelmann, A., Corman, V. M., & Drosten, C. (2020). An analysis of SARS-CoV-2 viral load by patient age. Mimeo. Berlin: Charité - Universitätsmedizin Berlin.
- Kuhfeld, M., & Tarasawa, B. (2020). The COVID-19 slide: What summer learning loss can tell us about the potential impact of school closures on student academic achievement. NWEA.
- Lamb, A. T., & Mbekeani, P. P. (2017). Private school choice in the wake of the Great Recession. Mimeo. Boston: Harvard University.
- McDonald, D., & Schultz, M. (2015). *United States Catholic elementary and secondary schools 2014-2015*. Arlington, VA: National Catholic Educational Association.
- McDonald, D., & Schultz, M. (2020). *United States Catholic elementary and secondary schools 2019-2020: The annual statistical report on schools, enrollment and staffing*. Washington, DC: National Catholic Education Association.
- McFarland, J., Hussar, B., Zhang, J., Wang, X., Wang, K., Hein, S., Diliberti, M., Forrest Cataldi, E., Bullock Mann, F., & Barmer, A. (2019). The condition of education 2019 (NCES 2019-144). U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Moreno, J. M., & Gortazar, L. (2020). Schools' readiness for digital learning in the eyes of principals: An analysis from PISA 2018 and its implications for the COVID19 (Coronavirus) crisis response, Education for Development Blog, Washington, DC: The World Bank.
- Murnane, R. J., & Reardon, S. F. (2018). Who goes to private school? Long-term trends in private school enrollments by family income, *AERA Open*, 4(1), 1-24
- Murnane, R. J., Reardon, S. F., Mbekeani, P. P., & Lamb, A. (2018). Who goes to private school? Long-term enrollment trends by family income, *Education Next*, 18(4).
- National Catholic Educational Association. (2019). *The annual financial report: Catholic elementary and secondary Schools in the United States: 2018/2019*. Arlington, VA: National Catholic Educational Association.
- National Catholic Education Association. (2018). *The Catholic school choice: Understanding the perspectives of parents and opportunities for more engagement*. Washington, DC: NCEA.
- Organisation for Economic Cooperation and Development (OECD). (2018a). *TALIS 2018 results (volume I): Teachers and school leaders as lifelong learners*. Paris: OECD.
- Organisation for Economic Cooperation and Development (OECD). (2018b). *TALIS 2018 results (volume II): Teachers and school leaders as valued professionals*. Paris: OECD.
- Quinn, D. & Polikoff, V. (2017). *Summer learning loss: What is it, and what can we do about it*. Washington, DC: Brookings Institution.
- San Diego and Imperial Valley Catholic Schools. (2020). Pandemic response reference planner office for schools 2019-2020 school year. San Diego: San Diego and Imperial Valley Catholic Schools

- Scaffidi, B., & Wearne, E. (2020). An open letter to independent school leaders. Mimeo, Coles College of Business, Kennesaw State University.
- Secretaria Status. (2018). *Statistical yearbook of the church 2016*. Rome: Libreria Editrice Vaticana.
- Shores, K., & Steinberg, M. P. (2019). Schooling during the great recession: Patterns of school spending and student achievement using population data. *AERA Open*, 5(3), 1-29.
- Smith, G., et al. (2015). *America's changing religious landscape*. Washington, DC: Pew Research Center.
- Snyder, T.D., de Brey, C., & Dillow, S. A. (2019). *Digest of education statistics 2018* (NCES 2020-009). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.
- UNESCO, UNICEF, World Bank, & World Food Programme. (2020). *Framework for reopening schools*. New York, Washington, DC, and Rome: UNESCO, UNICEF, World Bank, and World Food Programme.
- Wodon, Q. (2017). Catholic schools in the United States: Basic diagnostic of trends in enrollment and student achievement. *International Journal of Education Law and Policy*, 14, 37-52.
- Wodon, Q. (2018). Enrollment in K12 Catholic schools: Global and regional trends. *Educatio Catholica*, IV(3), 189-210.
- Wodon, Q. (2019a). Pluralism, the public purse, and education: An international estimate of savings to state budgets from K-12 Catholic schools. *Review of Faith & International Affairs*, 17(2), 76-86.
- Wodon, Q. (2019b). More schools, larger schools, or both? Patterns of enrollment growth in K12 Catholic schools globally. *Journal of Catholic Education*, 22(1), 135-53.
- Wodon, Q. (2019c.) Budget savings from private primary and secondary schools in OECD and partner countries. *International Journal of Education Law and Policy*, 15, 29-36.
- Wodon, Q. (2019d). Measuring the contribution of Faith-based schools to human capital wealth: Estimates for the Catholic church. *Review of Faith & International Affairs*, 17(4), 94-102.
- Wodon, Q. (in press-a). Enrollment in Catholic schools in the United States, Great Britain, and Ireland: Diverging trends, similar trade-offs?, *Educatio Catholica*.
- Wodon, Q. (in press-b). Declining enrollment in Catholic schools in the west and insights from the United States. *Journal of Catholic Education*.
- Wodon, Q. (in press-c). COVID-19 crisis, impacts on Catholic schools, and potential responses: Part II: Developing countries with focus on sub-saharan Africa. *Journal of Catholic Education*.
- Wodon, Q. (in press-d). Enrollment in Catholic higher education: Global and regional trends. *Journal of Catholic Higher Education*.
- Wodon, Q., Fèvre, C., Malé, C., Nayihouba, A., & Nguyen, H. (2020). *Ending violence in and around schools: Potential benefits and promising interventions*. Washington, DC: The World Bank.
- World Bank. (2018). *World development report 2018: Learning to realize education's promise*. Washington, DC: The World Bank.
- Zhang, J., Litvinova, M., Liang, Y., Wang, Y., Wang, W., Zhao, S., Wu, Q, Merler, S., Viboud, C., Vespignani, A., Ajelli, M., & Yu, H. (2020). Changes in contact patterns shape the dynamics of the COVID-19 outbreak in China. *Science*. 10.1126/science.abb8001.