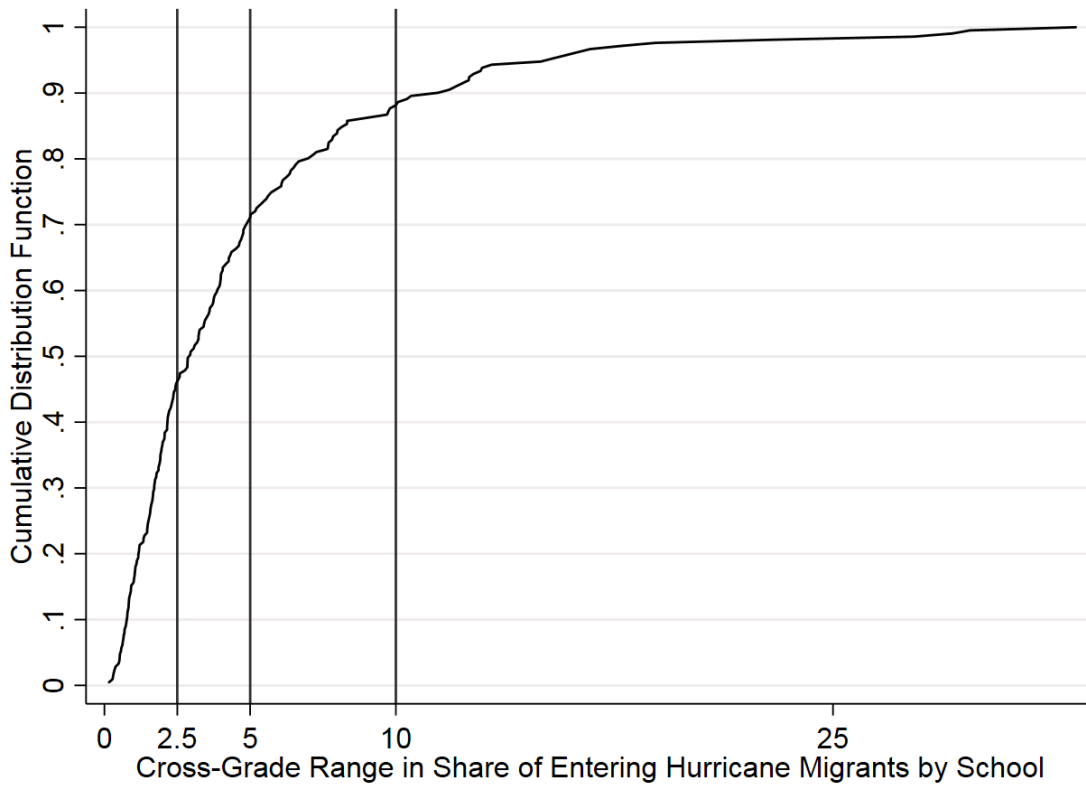


# Online Appendix—Examining the Educational Spillover Effects of Severe Natural Disasters: The Case of Hurricane Maria

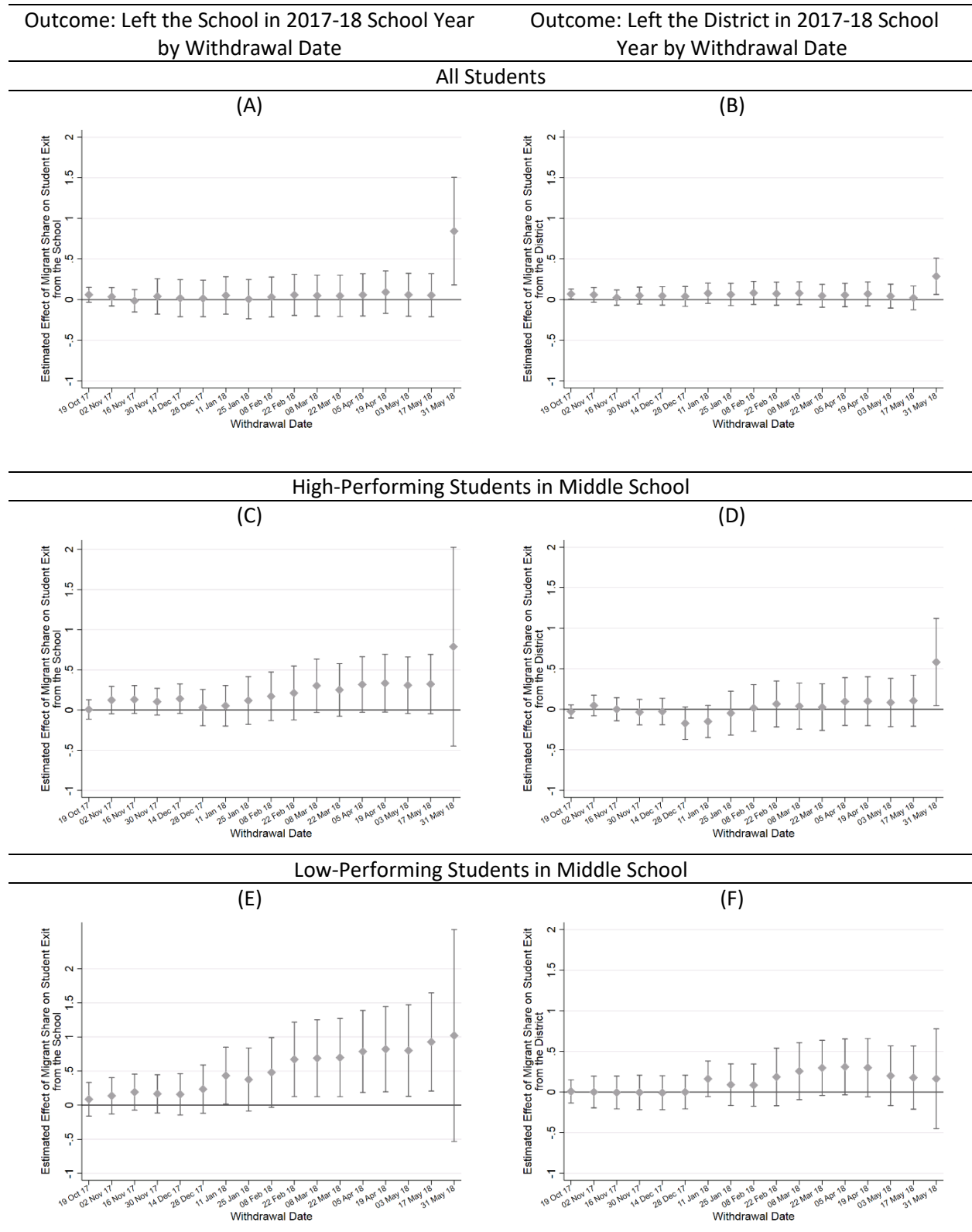
Umut Özek

Appendix Figure 1 – Distribution of the Cross-Grade Range in Puerto Rican Migrant Share by School



Notes: Figure presents the cumulative distribution of the cross-grade range in the share of Puerto Rican hurricane migrants by school. The migrant share is multiplied by 100.

Appendix Figure 2 – The Effects of Migrant Share on Student Mobility During the 2017-18 School Year



Notes: Each bar in Panel A presents the estimated coefficient (along with the 95% confidence interval) on the migrant share variable (using Equation (1)) in regressions where the dependent variable is an indicator that equals

1 if the student left the school they attended at the beginning of 2017-18 school year by the date given on the x-axis (the last entry on the x-axis represents the end of school year). Panel B repeats the same analysis replacing the outcome with an indicator that equals 1 if the student left the district by the date given on the x-axis. Panels (C) and (D) repeat the same analysis for high-performing middle school students who were proficient in both subjects in the previous school year whereas Panels (E) and (F) use the sample of low-performing middle school students who were not proficient in both subjects. Regressions exclude students who were in the terminal grades of their schools.

Appendix Table 1 – Estimated Associations between Existing Student Characteristics and the Share of Age-Appropriate Hurricane Migrants by School-Grade

	(I)	(II)
School fixed-effects	No	Yes
Prior year outcomes		
ELA score	-0.042*** (0.008)	0.005 (0.004)
Math score	-0.036*** (0.009)	0.007 (0.006)
Disciplinary incident	-0.111 (0.125)	-0.005 (0.111)
% absent days (0-100)	0.181*** (0.028)	-0.056*** (0.016)
Other student characteristics		
Born in Puerto Rico	1.368*** (0.086)	-0.043 (0.051)
White	-2.525*** (0.217)	0.004 (0.080)
Black	-2.806*** (0.276)	-0.125* (0.074)
Hispanic	5.572*** (0.266)	0.097 (0.090)
Male	0.050 (0.064)	-0.016 (0.097)
English non-native	4.008*** (0.203)	0.059 (0.095)
U.S. born	-0.429*** (0.111)	-0.040 (0.059)
Received subsidized meals	4.582*** (0.403)	-0.011 (0.074)
Special education	-0.177 (0.131)	0.053 (0.064)
English learner	1.940*** (0.131)	0.044 (0.104)
Age (in days)	-3.957*** (0.787)	0.254 (0.576)
Cohort size	4.366** (2.138)	1.337 (1.421)

Notes: Standard errors, clustered at the school-by-grade level, are given in parentheses. The estimated coefficients represent the coefficient on the age-appropriate hurricane migrant share variable (in percentage points) in regressions where the dependent variable is the corresponding student or cohort characteristic with and without school fixed-effects. Age-appropriate migrant share is defined as the number of Puerto Rican hurricane migrants who are age-appropriate for the grade in which they are placed divided by the number of existing students in the school-grade at the beginning of 2017-18, multiplied by 100. \*, \*\*, \*\*\* statistical significance at 10, 5, and 1 percent levels. Indicator variables are multiplied by 100.

Appendix Table 2 – Effects of Hurricane Migrant Share on Existing Student Outcomes in the First Year, by Grade Level and Student Prior Achievement, 2SLS Estimates

		Test scores	Disciplinary incidents	Absence rate	Left school by 2018-19
All students					
	Overall	-0.007 (0.004)	0.265** (0.113) [12.207]	-0.004 (0.022) [5.574]	0.644*** (0.178) [21.536]
	Elementary school	0.004 (0.004)	0.089 (0.084) [5.385]	-0.008 (0.016) [4.723]	0.585*** (0.180) [23.145]
	Middle or high school	-0.019** (0.008)	0.495 (0.379) [16.904]	0.027 (0.072) [6.160]	2.227*** (0.787) [19.552]
High-performing students					
	Overall	-0.015*** (0.005)	0.473** (0.197) [6.364]	0.057** (0.028) [4.139]	1.791 (1.247) [15.220]
	Elementary school	0.001 (0.004)	0.352** (0.174) [3.950]	0.038 (0.024) [4.315]	2.660** (1.206) [16.758]
	Middle or high school	-0.043*** (0.011)	1.013** (0.481) [7.817]	0.101 (0.068) [4.033]	4.939** (2.445) [13.313]
Low-performing students					
	Overall	0.003 (0.007)	0.180 (0.434) [24.678]	-0.054 (0.046) [6.069]	1.156 (0.966) [27.225]
	Elementary school	0.008 (0.006)	0.288 (0.298) [11.246]	-0.083* (0.043) [5.539]	1.921** (0.836) [29.454]
	Middle or high school	-0.000 (0.011)	-0.270 (0.885) [30.332]	-0.007 (0.082) [6.292]	4.952* (2.932) [25.444]

Notes: Standard errors, clustered at the school-by-grade level, are given in parentheses. The number provided present the 2SLS results instrumenting for the migrant share variable with the age-appropriate migrant share variable. All regressions include grade and school fixed-effects, student attributes given in Table 2, and their averages at the school-by-grade level. F-stats of the excluded instrument range between 36 and 761. \*, \*\*, \*\*\* represent statistical significance at 10, 5, and 1 percent levels. Regressions where the dependent variable is the indicator for leaving school before the start of 2018-19 school year exclude students in the terminal grades of their schools. The numbers in brackets provide the dependent variable mean for the given subsample. Indicator variables are multiplied by 100.

Appendix Table 3 – The Pseudo Effects of Hurricane Migrant Share on Existing Student Outcomes in 2016-17

		Test scores	Disciplinary incidents	Absence rate	Left school by 2017-18
<b>All students</b>					
	Overall	-0.004 (0.004)	0.074 (0.100) [12.401]	0.028 (0.019) [6.116]	-0.175 (0.131) [21.171]
	Elementary school	-0.002 (0.004)	0.081 (0.093) [5.831]	0.014 (0.011) [4.935]	-0.155 (0.131) [22.573]
	Middle or high school	0.000 (0.008)	0.098 (0.278) [17.023]	0.045 (0.062) [6.946]	-0.817* (0.433) [19.528]
<b>High-performing students</b>					
	Overall	-0.006 (0.005)	-0.003 (0.200) [6.556]	0.014 (0.020) [4.104]	0.146 (1.757) [14.192]
	Elementary school	-0.005 (0.005)	0.162 (0.179) [4.082]	-0.012 (0.020) [3.924]	-2.414 (1.689) [14.957]
	Middle or high school	-0.003 (0.010)	-0.140 (0.407) [7.952]	0.035 (0.045) [4.206]	1.835 (2.089) [13.352]
<b>Low-performing students</b>					
	Overall	-0.001 (0.005)	0.449 (0.276) [24.148]	0.056* (0.032) [6.405]	-0.200 (0.468) [23.248]
	Elementary school	0.004 (0.006)	0.689*** (0.225) [12.136]	-0.005 (0.034) [5.469]	-0.832 (0.609) [24.904]
	Middle or high school	0.001 (0.010)	0.106 (0.626) [30.339]	0.092 (0.067) [6.888]	2.332 (1.411) [21.936]

Notes: Standard errors, clustered at the school-by-grade level, are given in parentheses. The estimated represent the coefficient on the migrant share variable (in percentage points) assigned to students in school  $s$  and grade  $g$  in 2016-17 school year in regressions where the outcome is the corresponding outcome of interest in 2016-17 controlling for grade and school fixed-effects, student attributes listed in Table 2, and their averages at the school-by-grade level. The second and third panels repeats the same analysis for high-performing students who were proficient in both subjects and low-performing students who were not proficient in both subjects in 2015-16 school year. \*, \*\*, \*\*\* statistical significance at 10, 5, and 1 percent levels. Indicator variables are multiplied by 100. The numbers in brackets provide the dependent variable mean for the given subsample. Regressions where the dependent variable is the indicator for leaving school before the start of 2017-18 school year exclude students in the terminal grades of their schools.

Appendix Table 4 – Estimated Associations between Existing Student Characteristics and School-by-Grade Hurricane Migrant Share, Conditional on Staying in the District in 2018-19 School Year

Prior year outcomes		
	ELA score	0.004 (0.004)
	Math score	0.004 (0.006)
	Disciplinary incident	0.013 (0.091)
	% absent days (0-100)	-0.039*** (0.014)
Other student characteristics		
	Born in Puerto Rico	-0.048 (0.045)
	White	0.013 (0.070)
	Black	-0.051 (0.064)
	Hispanic	0.028 (0.081)
	Male	-0.020 (0.094)
	English non-native	0.010 (0.085)
	U.S. born	0.007 (0.056)
	Received subsidized meals	0.062 (0.064)
	Special education	0.020 (0.064)
	English learner	0.072 (0.096)
	Age (in days)	0.034 (0.468)
	Cohort size	1.656 (1.432)

Notes: Standard errors, clustered at the school-by-grade level, are given in parentheses. The estimated coefficients represent the coefficient on the migrant share variable (in percentage points) in regressions where the dependent variable is the corresponding student or school-by-grade characteristic for students who stayed in the district until in 2018-19 school year. School-by-grade migrant share is defined as the number of Puerto Rican hurricane migrants who entered the school-grade between September 20, 2017 and the end of 2017-18 school year divided by the number of existing students in the school-grade at the beginning of 2017-18, multiplied by 100. \*, \*\*, \*\*\* statistical significance at 10, 5, and 1 percent levels. Indicator variables are multiplied by 100.

Appendix Table 5 – Estimated First and Second Year Effects of Migrant Share on Existing Student Test Scores in Middle School with Imputed Test Scores for Attriters

		Effects in 2017-18 School Year		
		All students	High performers	Low-performers
Imputed value...				
	None	-0.016** (0.007)	-0.032*** (0.009)	0.002 (0.009)
	2016-17 year score	-0.014** (0.006)	-0.030*** (0.008)	0.002 (0.009)
	Prior 3-year average	-0.015** (0.006)	-0.030*** (0.008)	0.002 (0.009)
	Prior 3-year maximum	-0.014** (0.007)	-0.030*** (0.008)	0.002 (0.009)
	Prior 3-year minimum	-0.015** (0.006)	-0.029*** (0.008)	0.002 (0.008)
		Effects in 2018-19 School Year		
Imputed value...				
	None	0.005 (0.007)	-0.024** (0.010)	0.025*** (0.010)
	2017-18 year score	-0.010 (0.009)	-0.034*** (0.010)	0.004 (0.011)
	Prior 4-year average	-0.005 (0.007)	-0.027*** (0.009)	0.005 (0.010)
	Prior 4-year maximum	-0.005 (0.007)	-0.027*** (0.009)	0.005 (0.010)
	Prior 4-year minimum	-0.006 (0.008)	-0.025*** (0.009)	0.002 (0.011)

Notes: Standard errors, clustered at the school-by-grade level, are given in parentheses. The estimated coefficients represent the coefficient on the migrant share variable (in percentage points) in test score regressions where students who left the sample before being tested in 2017-18 (upper panel) or 2018-19 (lower panel) are assigned the corresponding test score based on their test score history. All regressions control for grade and school fixed-effects, student attributes listed in Table 2, and their averages at the school-by-grade level. \*, \*\*, \*\*\* statistical significance at 10, 5, and 1 percent levels.



Appendix Table 6 – Differential Effects of Hurricane Migrant Share on Existing Middle School Student Test Scores in the First Year, by Existing Student Prior Achievement and Migrant Educational Needs

	All students	Low performers	High performers
By migrant English learner status			
Migrant share * % English learner	-0.082 <sup>***</sup> (0.024)	-0.020 (0.029)	-0.123 <sup>***</sup> (0.029)
Migrant share	0.057 <sup>***</sup> (0.021)	0.023 (0.025)	0.076 <sup>***</sup> (0.026)
By migrant special education status			
Migrant share * % special education	-0.068 <sup>**</sup> (0.028)	-0.018 (0.038)	-0.115 <sup>***</sup> (0.040)
Migrant share	0.004 (0.010)	0.009 (0.014)	-0.000 (0.014)

Notes: Standard errors, clustered at the school-by-grade level, are given in parentheses. The estimated coefficients represent the coefficient on the migrant share variable (in percentage points) and its interaction with the share of migrants who are identified as English learners (upper panel) or special education students (lower panel) in schools and grade g at the time of their entry into the district. All regressions control for grade and school fixed-effects, student attributes listed in Table 2, and their averages at the school-by-grade level. \*, \*\*, \*\*\* statistical significance at 10, 5, and 1 percent levels.

Appendix Table 7 – The Effects of Hurricane Migrant Share on Existing Student Outcomes in 2017-18, Conditional on Observing the Relevant Outcome in 2018-19, by Grade Level and Student Achievement in 2016-17

		Test scores	Disciplinary incidents	Absence rate
<b>All students</b>				
	Overall	-0.008** (0.004)	0.120 (0.083) [9.721]	-0.020 (0.012) [4.558]
	Elementary school	-0.003 (0.004)	0.000 (0.069) [5.382]	-0.016 (0.012) [4.515]
	Middle or high school	-0.015** (0.006)	0.852* (0.441) [16.579]	-0.013 (0.044) [4.626]
<b>High-performing students</b>				
	Overall	-0.013*** (0.004)	0.364** (0.145) [5.804]	0.024 (0.022) [3.986]
	Elementary school	-0.005 (0.004)	0.210 (0.133) [3.925]	0.016 (0.022) [4.185]
	Middle or high school	-0.031*** (0.008)	1.082*** (0.356) [7.265]	0.059 (0.060) [3.831]
<b>Low-performing students</b>				
	Overall	0.000 (0.005)	0.534* (0.301) [22.317]	-0.009 (0.036) [5.570]
	Elementary school	-0.000 (0.006)	0.421* (0.255) [11.341]	-0.023 (0.034) [5.361]
	Middle or high school	0.005 (0.009)	0.570 (0.715) [28.318]	0.022 (0.061) [5.684]

Notes: Standard errors, clustered at the school-by-grade level, are given in parentheses. The estimated represent the coefficient on the migrant share variable (in percentage points) for the corresponding outcome of interest in the first year conditional on observing the student in the sample in 2018-19 school year. The numbers in brackets provide the dependent variable mean for the given subsample. All regressions control for grade and school fixed-effects, student attributes listed in Table 2, and their averages at the school-by-grade level. \*, \*\*, \*\*\* represent statistical significance at 10, 5, and 1 percent levels. Regressions where the dependent variable is the indicator for leaving school before the start of 2018-19 school year exclude students in the terminal grades of their schools. Indicator variables are multiplied by 100.