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Teaching in the Right Context: Textbook Supply

Program, Language, and Vocabulary Ability in Vietnam

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Abstract

While past two decades have witnessed a remarkable educational progress in Vietnam, ethnic minority children consistently lagged behind ethnic majority children in academic performance. The government of Vietnam has stepped up efforts to assist ethnic minority students in their learning by lowering the linguistic and cultural barriers they face. Among such efforts is the textbook supply program, and we examine its impact on the learning of children proxied by vocabulary test. We apply difference-in-differences estimation to four rounds of the Young Lives data between 2006 and 2015 in order to investigate how the textbook supply program narrowed the gap between the ethnic minority and majority over time. We show that the textbook supply program became more effective in narrowing the ethnic gap as the education policy in Vietnam became reoriented towards ethnic minority children. We also conduct a causal mediation analysis to explore the relevance of behavioural response through the change in time use. The result of this analysis suggests that increased study time is possibly a moderate mediator through which the textbook supply program helps narrow the ethnic gap in the test score only for the young cohort over and above the direct impact from the textbook program. This paper therefore alludes to the importance of delivering carefully designed materials for the target group to bring about meaningful behavioral changes. It also corroborates the findings from the recent literature on teaching at the right level.

JEL Codes: I24, I25, J15, O12

Keywords: ethnic minority, mediation, difference in differences, PPVT, Vietnam

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Teaching in the Right Context: Textbook Supply Program, Language, and Vocabulary Ability in Vietnam

1. Introduction

Textbook is an essential learning material. Many studies find textbook programs to be effective in improving student learning (Glewwe et al., 2011; Yamauchi and Liu, 2013). Literature has provided evidence that other provisions such as increasing student learning computers, tutoring, and teacher training also increase student learning, but textbook provision is found to be one of the most cost-effective interventions to improve learning (McEwan, 2015). Nevertheless, recent studies show that textbook program alone does not necessary lead to an increase in average test scores. Glewwe et al. (2009) found that a textbook intervention in Kenya had a positive effect on top students but little effects on others because the textbooks were oriented towards the above average children, which made it difficult for the rest of the children to use the textbooks effectively even if they had them. Similarly, Kuecken and Valfort (2013) found that having a textbook improved test scores of children with top socioeconomic status, but not others. Textbook intervention would also have no effect if the textbooks do not reach the students (Sabarwal et al., 2014). It was reported that textbook provision could be more effective in improving student learning if it was accompanied by other instruments such as teacher training program (Popova, et al., 2016). Piper et al. (2018) examined different ingredients of educational intervention in Kenya including provision of textbook redesigned to match the actual skill level of students in grades 1 and 2, and found that textbook provision coupled with teacher professional development and instructional support resulted in improved literacy and numeracy. These findings suggest that the textbook supply program may not improve the learning of children unless the textbooks are adequately distributed and both textbooks and curriculum are designed in a way that is suitable for the target children.

Another potential important factor that affects the success of textbook programs is language. Several studies show that language has an important impact on children's learning. For example, Eriksson (2014) examines the effect of change in language of instruction from English or Afrikaans to mother-tongue of black primary students and finds positive impact on a range of outcomes such as reading and writing ability. Dustmann et al. (2010) investigate the gaps in English test scores at the beginning of compulsory schooling in England across different ethnicities and report that the children whose mother tongue is English scored 35.9

percent of a standard deviation higher than children whose mother tongues are not English. These studies underscore the importance of language and potentially negative impact of learning in non-native language.

Overall findings from the studies discussed above suggest that ethnic minority children are disadvantaged as they are likely to have to learn in their non-native language at school. Indeed, even though Vietnam has made remarkable advancement in education over the last decades, stark gap between ethnic majority and minority persists to date. Researchers have investigated the factors behind ethnic minority children lagging behind in education and identified language barrier as a source of inequality not only in economic perspective (Nguyen et al., 2017b) but also in education (Baulch et al., 2007; Glewwe et al., 2015; London, 2006; London 2010; Trieu and Jayakody, 2019). Therefore, it is important to examine how changes in factors that complement textbook programs—such as appropriate curricula and language— altered the way they affect the learning of ethnic minority relative to that of ethnic majority children.

The current paper studies the impact of Vietnam's textbook supply program on the language skills of ethnic majority and minority children proxied by vocabulary test results. We examine the impact using test results from four rounds of survey data between 2006 and 2016, a period in which the Vietnamese government and donors increased their efforts to improve the quality of education and make school curriculum more inclusive. This policy reorientation involved promotion of the use of ethnic minority languages in areas with a high concentration of ethnic minority students, creation and distribution of textbooks in ethnic minority languages, and training of teachers who could use ethnic minority languages to teach ethnic minority students effectively as elaborated in the next section. We conjecture that these changes enabled ethnic minority children to disproportionately benefit from the textbook supply program. Using microdata for children in two different cohorts, we investigate how the impact of the textbook supply program on language skills of minority children relative to those of majority children changed. While we focus only on Vietnam, the issue we are addressing in this study is potentially relevant to a sizable proportion of the world population, because nearly one third of the world population could be considered as living as minority in a broad sense.[4] As we argue at the end of the paper, the current study elucidates the importance of teaching in the right

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[4] Fearon (2003) reports that the average population share of the largest ethnic group in the world is 65 percent.

context to promote the students' learning, an aspect of education that has not received sufficient attention in the existing literature.

This paper is organized as follows. In the next section, we provide the study context and background. In Section 3, we describe the econometric specification. Section 4 presents the data and measurement of outcomes, followed by the results in Section 5. Finally, Section 6 provides some discussion.

2. Background: Ethnic Minority Education and Textbook Development in Vietnam

Vietnam has one of the most diverse ethnicities and languages in Asia with 54 different ethnic groups who speak more than 109 living languages[5], where the most populous ethnic group called Kinh (Vietnamese) accounts for 85.3 percent of the total population (Central Population and Housing Census Steering Committee, 2019). The country successfully achieved a rapid economic growth over the last decades with poverty headcount ratio dropping from 20.7 percent in 2010 to 6.7 percent in 2018 (World Bank, 2020). Though this decline in poverty benefitted both ethnic minority and majority groups, there remains a stark difference in poverty between the two groups.[6] In fact, a number of studies have found evidence of economic inequality across ethnic groups, that is, ethnic minorities still suffer more from poverty in Vietnam (Baulch et al., 2007; Fujii, 2018; Nguyen et al., 2017a; van de Walle and Gunewardena, 2001).

Similarly, while Vietnam has made a remarkable progress in education over the last few decades, ethnic minorities have consistently lagged behind in education. For example, Fujii (2018) reports that the proportion of people living with a household head who has not completed primary education has dropped from 21.3 percent to 10.7 percent for the Kinh-Hoa ethnic majority between 1993 and 2014, whereas the corresponding proportion for the ethnic minority marginally increased from 40.5 percent to 41.3 percent in the same period. In a case study of two remote schools in areas with relatively high concentration of ethnic minority students, Aikman and Pridmore (2001) observe that these schools suffer from many issues such as lack of books, teaching materials, facilities, and conditions conducive to learning.

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[5] Ethnologue: languages of the world (http://ethnologue.com/region/SEA) accessed on November 11, 2020.
[6] Poverty headcount rates in 2016 were 44.6% for ethnic minorities and 3.1% for the majority (Pimhidzai, 2018).

The above is true despite the fact that Vietnam has actually endorsed a fairly open language policy since independence. For example, Article 15 of Vietnamese Constitution 1946 states, "In local primary schools, citizens of ethnic minorities shall have the right to be educated in their own language" and subsequent revisions of constitutions have included similar clauses. Nevertheless, the actual implementation of policies for ethnic minority languages in school education has been slow and limited particularly until early 2000s (Ha et al., 2014; Nguyen and Nguyen, 2019), and there are at least four reasons for this.

First, the supply of ethnic minority teachers has been limited. Even when teachers are able to speak an ethnic minority language, they may not be able to write the ethnic minority language[7] or teach Vietnamese as a second language due to the lack of relevant training (Chi, 2011; Diep and Thanh, 2009; World Bank, 2009). When the teacher cannot speak the ethnic minority language, the effectiveness of teaching ethnic minority children can be severely undermined, because of the lack of common language (Aikman and Pridmore, 2001; Phuong and Baulch, 2007).

Second, despite the presence of the policies for ethnic minority languages, the efforts have been exerted disproportionately in the teaching of Vietnamese. Vietnamese government has emphasized that ethnic diversity should not compromise national unity and mandated Vietnamese as the common language for people of all the ethnicity in the polity (Nguyen, 2019). Many government officials see the teaching of Vietnamese to ethnic minority children as early as possible as the best way to alleviate the situation of the ethnic minority (Ha et al., 2014).

Third, even when a minority language is used in school, it is taught as a subject and not as a medium of instruction. Hence, minority students with limited command of Vietnamese tend to struggle. Finally, the lack of textbooks, among others, has been severe in remote and poor areas. For example, it was reported that about half of school-goers in the Central and Central Highlands Region where 90 percent of the students are ethnic minority do not have textbooks (*Vietnam Economic News*, 1999). Even when textbooks are available, they are often only in Vietnamese (Phuong and Baulch, 2007; *Economist*, 2015).

Over the past one and a half decades, some progress has been made to tackle these educational issues for the ethnic minority group with more laws and decrees adopted and implemented to encourage the preservation and use of ethnic minority languages. For example, Article 7 of the Education Law in 2005 (No. 38/2005/QH11) states that the State shall create

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[7] Many ethnic minority languages have only a short history of written scripts, if there is any.

conditions for ethnic minority people to learn their spoken and written languages in order to preserve and develop their respective cultural identities, helping ethnic minority pupils easily absorb knowledge when they study in schools or other educational institutions. Another important example is Decree No. 82/2010/ND-CP, which aims to promote teaching and learning of spoken and written languages of ethnic minorities in general education facilities and continuous learning centers.[8]

Correspondingly, efforts have been devoted to teacher training, materials development, and capacity building, which would be helpful for effectively teaching ethnic minority children. Among the most notable examples is the joint action research project by the Ministry of Education and Training (MoET) and United Nations Children's Fund (UNICEF) on Mother Tongue-Based Bilingual Education (MTBBE) first implemented in 2008. Under this programme, teachers were trained to teach in the mother tongue of minority students, and textbooks for minority students were developed. Inspired by the MoET-UNICEF MTBBE, government policies also changed on an annual basis (UNICEF, 2015). According to the quotation from a MoET official, Mong, Ede, Jrai, Bahnar, Cham and Khmer languages were first taught at school in the 2010-2011 academic year with 740 schools, 4,789 classes, and 110,862 students (*Vietnam News Agency*, 2017). In 2012, teaching and learning of 12 ethnic minority languages were carried out in 32 provinces and universalization of primary education standards was achieved in all communes (United Nations, 2013).

Initiatives by multilateral banks were also put in place. One such initiative by the World Bank is the Renovation of General Education Project, which started in 2015 to improve the learning outcomes. One of the project components is to develop textbooks aligned with the revised curriculum and to provide the textbooks to schools with high numbers of economically disadvantaged students. Similarly, developing competency-based textbooks for ethnic minority areas is taken as one of the important outputs in the second phase of the Lower Secondary Education for the Most Disadvantaged Areas Project, which has been implemented by the Government of Vietnam and supported by the Asian Development Bank since 2015. While our data capture little, if any, of the impacts of these programs, the fact that these programs were implemented by multilateral banks in partnership with the Vietnamese government reflects the increased attention to the education of ethnic minority children in the past decade.

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[8] See also Kosonen (2013) for further discussion on language-in-education policies in Vietnam.

Based on the discussion above, we conjecture that the textbook supply program, which has enabled students with disadvantaged background to have access to textbooks, would have become more beneficial to ethnic minority students relative to ethnic majority students from late 2000s. We verify this conjecture through a difference-in-differences estimation of the impact of the textbook supply program for different cohorts using the child-level Young Lives (YL) data described in detail in Section 4.

Since the YL data is not representative of Vietnam, it is useful to briefly describe the schooling situation in the YL study areas using two rounds of school surveys accompanying the YL data.[9] The first [second] round of the school survey, which was conducted in in 2011-12 [2016-17], involves over 90 primary school [50 secondary schools]. Ethnic minority students account for 12 [16] percent of all students in the first [second] round with 65 [143] out of 176 [220] class having at least one minority student, where the class size is 19 [40] students on average.

While ethnic minority students are common in the YL sample, ethnic minority teachers are rare. There are only two [eight] ethnic minority teachers out of 176 [211] teachers in the first [second] round of school survey. Further, more than 30 percent of teachers came from a province other than the local province in the first round and nearly half of them had at least one minority student in class. Therefore, a sizable fraction of teachers may not be familiar with the local context relevant to the ethnic minority students. Besides, the first round of school survey shows that all teachers teaching grade 5 classes were using Vietnamese most often to teach and only about 10 percent of teachers sometimes use non-Vietnamese language to teach grade 5 classes. These points are all consistent with the presence of linguistic disadvantage that ethnic minority students face, despite the improvements over the past decade.

It is also worth highlighting that the lack of textbooks is important for the YL sample, particularly for the ethnic minority group. The first round of school survey shows that the proportions of students without Vietnamese Volume 1, Volume 2, and Mathematics textbooks are, respectively, 2 [5], 8 [46], and 3 [8] percent for ethnic majority [minority] students. These also indicate that the textbook program, if designed suitably for ethnic minority students, would disproportionately benefit ethnic minority students relative to majority students.

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[9] The design of the school survey and some summary statistics and analyses of the school survey data can be found in Rolleston et al. (2013) and Padmini et al. (2017).

The current study is not the first study to shed light on the educational gap between ethnic minority and majority using the YL data in Vietnam. However, existing studies such as Rolleston and Krutikova (2014), Arouri et al. (2019), and Glewwe et al. (2015) do not evaluate the impact of textbook intervention. To our knowledge, this is the first study to evaluate the impact of textbook supply program using a quasi-experimental design and underscore the relevance of recent ethnic minority language policies in Vietnam.

3. Econometric specification

Our primary research interest is in the way textbook supply program affected the ethnic minority and majority groups differently. As such, we primarily use a differnece-in-differences specification, in which one difference is taken by the textbook supply program status (i.e., difference between the children who are in the communities with and without the textbook supply program) and the other by the ethnic minority status (i.e., difference between ethnic minority and majority children). Here, we regard Kinh as ethnic majority and all other ethinic groups as ethnic minority.[10] Our primary outcome of interest is the Peabody Picture Vocabulary Test (PPVT) as described in detail in the next section and Appendix A.

To formally introduce our econometric model, we denote the indicator variable for ethnic minority for individual i by M_i. That is, M_i takes a value of zero [one] if individual i belongs to the ethinic majority group (i.e., Kinh) [the ethinic minority group (i.e., non-Kinh)]. Likewise, we denote the indicator variable for the status of textbook supply program for individual i by E_i, which takes one if the textbook supply program exists in the commune of i's residence and zero otherwise. The outcome of interest, or the PPVT score, is denoted by Y_i. Using these notations, our main difference-in-differences regression specification can be written as follows:

$$Y_i = \alpha + \beta M_i + \gamma E_i + \delta M_i E_i + \kappa X_i + \varepsilon_i, \tag{1}$$

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[10] Hoa (Chinese) group is often treated as a part of the ethnic majority group in existing studies. In our dataset, which is described in detail in Section 4, we only have one Hoa student and this student is not treated as an ethnic majority student in our empirical analysis. However, the results do not change much even when the student is treated as an ethnic majority student.

where X_i is a set of additional covariates. The main coefficient of interest is δ, which represents the differential impact of the textbook supply program between ethnic minority and majority.

While the specification above has the advantage that we can directly focus on the differential impact between the ethnic minority and majority, one could argue that the way the covariates affect the outcome may vary with the ethnicity. Therefore, we also run the following regression separately for each of the ethnic minority and majority groups where the superscript $c \in \{Min, Maj\}$ represents the ethnic group child i belongs to:

$$Y_i = \alpha^c + \gamma^c E_i + \kappa^c X_i + \varepsilon_i, \tag{2}$$

Based on eq. (2), we also conduct a medication analysis to explore the potential causal channels through which the textbook supply program affects the outcome. Our main variable of interest as a mediator is the total study time T_i,[11] because students may spend more time studying when the textbook becomes more appropriate and readily available for their learning. Specifically, we consider the following linear structural equation modelling (LSEM) framework:

$$T_i = A^c + G^c E_i + K^c X_i + \eta_i, \tag{3}$$
$$Y_i = a^c + g^c E_i + \theta^c T_i + k^c X_i + e_i, \tag{4}$$

In this framework, we estimate eqs. (3) and (4) separately by ordinary least squares and denote the regression estiamtes with hat (^). Using the terminology of causal inference, E_i and X_i can be taken as treatement and pretreatment confounders, respectively. In this framwork, we can estimate the medication effect by the product of coefficients $\hat{\theta}^c \hat{G}^c$, which is identical to $\hat{\gamma}^c - \hat{g}^c$ in the linear model (MacKinnon et al., 2002). There are two key assumptions that would enable us to interpret the product of coeffcieints as an asympotically consistent estimate of the causal medication effect in the linear model (Imai et al., 2010b).

The first assumption is the no-interaction assumption, which states that the causal mediation effect does not depend on the treatment status. This is likely to be a reasonable assumption in our application since it is difficult for policy-makers to know in advance how

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[11] The total study time is defined as the total number of hours a child spends studying in school, studying at home, and studying in extra tuition outside home during a typical day.

much textbook supply programs would change the study time. Further, we also run regressions with the interaction term $E_i T_i$ included in eq. (4) and test the size and statistical significance of the coefficient on the interaction term for each survey round and for each of the ethnic minority and majority groups.

The second assumption is the sequential ignorability. As the name suggests, the following two ignorability assumptions are made sequentially under this assumption. First, given X_i, the potential outcomes and potential mediators are statistically independent of the treatement assignment. Second, given X_i and E_i, the potential outcome is statistically independent of the potential mediator.

The sequential ignorability assumption is violated when η_i and e_i are correlated. This assumption cannot be verified and may be potentially problematic. For example, students who are endowed with better genes may be able to study more efficiently and do better in the PPVT test than others, creating a negative correlation between η_i and e_i. On the other hand, students who have a better study environment at home may study more and do better in the test, creating a positive correlation between η_i and e_i. Since we cannot rule out possibilities like these, we conduct a sensitivity test as described in Imai et al. (2010a).

4. Data

As mentioned above, this study uses a dataset collected by the YL study, which followed 3,000 children in Vietnam. The sample consists of two cohorts made up of approximately 1,000 old and 2,000 young children. These children were drawn from 31 communities around 20 sentinel sites, and 100 children from the young cohort and 50 children from the old cohort were randomly selected from a list of eligible children aged one and eight, respectively, in 2001 within each sentinel site. To date, five rounds of surveys were conducted in 2002 (Round 1), 2006 (Round 2), 2009 (Round 3), 2013 (Round 4) and 2016 (Round 5). A detailed explanation of the sampling methodology is discussed in Nguyen (2008).

The YL dataset collects basic demographic, health, and wealth information on the household. Besides, the YL dataset features various tests on cognitive skills of children. This study uses the Peabody Picture Vocabulary Test (PPVT), which is administered when the child reaches 12 and 15 years of age. PPVT is a widely used test to measure receptive vocabulary, where a test taker is orally presented with a word and selects the picture that best represents its meaning. It was originally developed in English in 1959 and has been updated several times.

In Vietnam, the third version, adapted in the local language, was used. All scores are expressed as the percentage of questions answered correctly to ensure the comparability across different survey rounds.[12] PPVT is particularly suitable for our purpose, because it provides a direct measurement of language comprehension and is available at different ages for both the young and old cohorts unlike most other tests on cognitive skills in the YL dataset.

Table 1 provides the characteristics of the children in both the young and old cohorts when they are at ages 12 and 15. As the bottom of Table 1 indicates, data for the old-cohort [young-cohort] children when they were 12 and 15 years of age were collected, respectively, in rounds 2 and 3 [rounds 4 and 5] of the survey. Table 1 shows that slightly more than one in ten children are ethnic minority and about half of the children are girls in our sample. On average, both mothers and fathers of the children in the sample have about seven years of education, which corresponds to some lower secondary education. Children in the sample are predominantly rural. Interestingly, the PPVT score for the old cohort is better than that for the young cohort both at ages 12 and 15. The proportion of children covered under the textbook supply program is above 60 percent in all rounds. We provide the summary statistics tables disaggregated by each of the status of ethnicity and textbook supply program in Tables A1 and A2 for the old and young cohorts, respectively.

5. Results

We start with a simple DiD regression in eq. (1) separately for each of the old and young cohorts when they were at ages 12 and 15. Four columns in Table 2 represent, from left to right, the estimation results for the tests taken in 2006, 2009, 2013, and 2016. The results show that the estimated coefficient δ on $M \times E$ is negative and at best marginally significant for the old cohort. This indicates that the textbook supply program did not help narrow the gap between the ethnic minority and majority groups for the old cohort. On the other hand, the estimated coefficient of δ is positive, large, and statistically highly significant for the young cohort. This indicates that the textbook supply program appears to have helped narrow the gap between ethnic minority and majority groups for the young cohort. These results can be interpreted that the impact of the textbook supply program on child learning became larger and more significant over time during the period when the curriculum became reoriented towards ethnic-minority children. This suggests that the complementary factors, such as appropriate curriculum for

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[12] Details of the adjustment is given in Appendix A.

ethnic-minority children and textbook in minority languages, reinforced the effect of the program.

Of course, the estimated coefficient of δ may merely reflect correlation and not causation. Therefore, let us carefully examine the impact of potential endogeneity of M and E. To facilitate the discussion, we assume away the additional covariates X. Alternatively, we may assume that all variables are conditional on X in what follows.

To understand the potential threat to identification, suppose first that the ethnic minority children live in a condition that is unfavourable to achieve a high PPVT score. In other words, they would do better if they had a condition similar to the ethnic majority children. This may be true, because ethnic minority children are poorer, live in larger household, and have less educated parents (Tables A1 and A2) and there are likely to be some similar unobservable factors that would lead to a negative correlation between M and ε. In this case, β is underestimated. However, provided that ε is uncorrelated with E, we are still able to consistently estimate δ because the level effect created by the correlation between M and ε is essentially differenced out. Similarly, we are able to consistently estimate δ when ε is correlated with E but uncorrelated with M.

Therefore, for our purpose, we would be only worried about the case where ε is correlated directly with $M \times E$. Given the recent shift in the focus of education policies for ethnic minority groups in Vietnam, it would be possible that the textbook supply program is prioritized in areas where ethnic minority children tend to underperform ethnic majority children and that this tendency is particularly strong for the young cohort. While we cannot exclude this possibility, it would lead to an underestimation of δ in this case. Therefore, our finding that the textbook supply program has narrowed the ethnic gap would be strengthened once the potential endogeneity of the policy implementation is taken into account.

One could also argue that the textbook supply program may be implemented in conjunction with other education support programs such as teacher training. Unfortunately, we do not have details for such programs in the data. Nevertheless, we can still interpret δ as the estimated impact of the textbook supply program and other related programs implemented together with it on the gap in the PPVT score between ethnic minority and majority children. Hence, we will regard the text supply program and other related programs as a single program and continue to call them collectively as textbook supply program to simplify the presentation.

As we noted earlier, eq. (1) imposes a restriction that κ is the same between the ethnic

minority and majority groups. To relax this, we estimate eq. (2) separately for the ethnic majority and minority groups and denote the estimates using superscripts Maj and Min, respectively. The DiD estimate in this setup is given by the difference $\hat{\gamma}^{Min} - \hat{\gamma}^{Maj}$. It turns out that the DiD estimate based on this is quantitatively and qualitatively similar (details upon request).

So far, we have only considered the total impact of the textbook supply program, which would include both direct program impact and possible indirect impact through the behavioural response. As we argued earlier, children may spend more or less time studying in response to the textbook supply program. To shed light on this possibility, we conduct a mediation analysis based on the LSEM in eqs. (3) and (4). As shown in Table 3, the indirect effect due to time use is highly significant for the young cohort of the ethnic minority group. In particular, at age 15, nearly one third of the total effect of the textbook supply program can be attributed to the indirect effect through the increase in the study time. By taking the difference between ethnic minority and majority groups, it can be seen that about a quarter of narrowing of the ethnic gap in the PPVT score due to the textbook supply program can be attributed to the differential indirect effect.[13]

It should be noted that study time does not appear to be an important mediator for the ethnic majority students and old-cohort ethnic mionrity students. For these groups, at least one of $\hat{\theta}^{Maj}$ or $\hat{G}^{Maj}$ is either insignificant or marginally significant (the details reported in Table A3). Further, the estimated indirect effect for these groups is insignificant except for the young-cohort ethnic majority students at age 12, for which the indirect effect is very small and only marginally significant as Table 3 shows.

A few cautions are in order here. First, in our analysis, we take the covariates to be pre-determined. Indicators such as parental education, age, and rural indicator are indeed likely to be pre-determined. However, it could be argued that the wealth index is not since the textbook intervention may affect wealth. We argue that this is unlikely to be important because the monetary value of textbook would be limited and also because the wealth index is derived from housing and asset indicators that are slow to change. Further, the omission of the wealth index from the covariates do not change the results much (details upon request).

Second, the causal mediation analysis rests on two critical assumptions as mentioned earlier. One of them is the no-interaction assumption. This assumption does not appear to pose

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[13] (2.828-(-0.082))/(8.629-(-2.763))=0.255.

an important issue. We run regressions based on eq. (4), including the interaction term $E_i T_i$, for each round and for each of the ethnic minority and majority groups. The coefficients on the interaction term are all statistically insignifincant at five percent level in these eight regressions. Furthermore, with the exception of old-cohort majority group at age 15, the coefficient was insignificant even at ten percent level. Hence, we do not find evidence that the no-interaction assumption is violated, at least for the young cohort.

Third, the causal mediation analysis also requires the sequantial ignorability asusmption. We cannot test this assumption directly and there are potential reasons to believe that it may be violated in reality as discussed earlier. Therefore, we conduct a sensitivity analysis as recommended by Imai et al. (2010a, 2010b). As we can see from Figure 1, the statistical significance of the average causal mediation effect for the young cohort of the ethnic minority group disappears when there is a moderately positive correlation between η_i and e_i. While the correlation between η_i and e_i may be positive or negative, this shows that a caution is required when interpreting the results of the causal mediation analysis.

Taking the arguments above together, we have a consistent set of evidence that the textbook supply program helped narrow the achievement gap between ethnic minority and majority for the young cohort but not for the old cohort. Our mediation analysis suggests that this is partly driven by the behavioural response of minority children by increasing time spent studying. This finding is consistent with our conjecture that the textbook supply became more relevant to the local context and benefitted ethnic minority students more than ethnic majority students.

6. Discussion

In this paper, we explored the differential impact of the textbook supply program on the PPVT score. As textbooks became more suitable for the ethnic minority group, the gap in the average PPVT score between the ethnic minority and majority groups narrowed. While the evidence from the mediation analysis is not very strong, it suggests that the intervention by the government helped narrow the ethnic gap over and above the direct effect from the intervention partly through the increased study time for the young-cohort ethnic minority group relative to the young-cohort ethnic majority group. It also suggests that it is important to deliver carefully designed materials to the target group in order to bring about meaningful behavioural changes. It is therefore encouraging that the Vietnamese government and multilateral aid agencies such

as the Asian Development Bank and World Bank are making efforts to increase the inclusiveness of education by improving the teaching materials, even though the ethnic minority students continue to face linguistic and cultural barriers. Our results serve as an early signal that such efforts are starting to bear fruits.

Nevertheless, there are two important limitations in this study. The first limitation is that we entirely focus on the *learning* of students and the long-term labour market outcomes are ignored. This point is important since the impact of language on labour market has been found to be significant in many studies. For example, English proficiency has been found to be positively associated with wages in a variety of contexts, including McManus (1985) for Hispanic workers in the US; Dustmann and Fabbri (2003) for migrant workers in UK; Di Paolo and Tansel (2015) for Turkey; Chiswick and Miller (1995) for workers in Australia, US, UK, and Israel; Wang et al. (2017) for China; Casale and Posel (2011) for South Africa; Toomet (2011) for ethnic Russians in Estonia and Latvia; and Azam et al. (2013) for workers in India. Similarly, Dustmann (1994) underscores the importance of German fluency, particularly writing fluency, for the earnings position of migrants. Duncan and Mavisakalyan (2015) find a positive relationship between wage and Russian proficiency in Armenia, Azerbaijan, and Georgia. Language proficiency is also found to be related to migration decisions (Adserà and Pytiková, 2016) and consumption pattern (Wang et al., 2016). Aldashev and Danzer (2020) relate the differential economic returns to language skills to changing gaps in school resources such as textbooks between schools of different languages of instruction in the multilinguistic Kazakhstan. A study in Morocco by Angrist and Lavy (1997) illustrates the importance of language by reporting that the switch of the language of instruction from French to Arabic in Morocco led to a substantial decline in the returns to schooling. Given the findings of the studies reviewed here and earlier, it is possible that the returns to learning in Vietnamese may be higher than learning in an ethnic minority language at least for some students, even if ethnic minority students can learn more effectively in the latter.

The second limitation is that we did not look into the relevance of teacher incentives due to data limitation. This is potentially an important channel, since recent studies such as Gilligan et al. (2019) and Mbiti et al. (2019) find that textbook provision program is effective in the presence of adequate teacher incentives. In Vietnam, teachers are indeed given substantial allowances if they work in remote or disadvantaged communities, which tend to have a higher concentration of ethnic minority students. Further, bonuses are available for teachers whose performance is deemed excellent, even though their financial value is low in

the eyes of many teachers (McAleavy et al., 2018). Some studies in Vietnam also suggest that ethnicity of teachers play an important role in promoting minority children's learning at school (Baulch et al., 2010; Giacchino-Baker, 2007). Further investigation will be needed to understand the complementarity in textbook supply program, use of minority languages, and teacher incentives in the context of Vietnam.

Despite these limitations, we argue that our results broadly corroborate the recent literature on "teach at the right level" (Banerjee et al., 2017; Baneji and Chavan, 2020), which suggests that the target students learn better when provided materials are more suitable for them. Our study shows the importance of teaching in a context that is relevant to and suitable for the target students, as existing qualitative evidence appears to indicate. For example, Wong and Benson (2019) study ethnic minorities in Cambodia and argue that the use of learners' own languages by new teachers from their own communities has been the key to provide equitable education. Based on a review of 223 studies evaluating educational interventions in developing countries, Ganimian and Murnane (2016) conclude that providing learning material improves students' performance only if it brings about changes in children's learning experiences by such means as provision of suitable textbooks and teacher training to improve their knowledge of how to use additional resources. There is also a sizable body of literature on the education of Indigenous people in Australia, which broadly indicates that understanding of appropriate pedagogy for them and complexities of Indigenous cultures, knowledge, and identities is important to conduct effective teaching for Indigenous students (See Santoro et al., 2010 and citations therein). Another study suggesting the importance of suitable learning places for minority students is Merry and Driessen (2012). They argue that Hindu schools in Netherland operate as an important form of cultural and religious mediation for children who otherwise may face higher risk of school failure. To our knowledge, this study is the first to quantitatively investigate the relevance of "teaching in the right context," an area of research that deserves more attention in economics, development studies, and educational research.

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Appendix A: Construction of a comparable PPVT score

YL study uses the PPVT version III to measure children's cognitive and language ability from round 2 to round 5. In this test, the YL child listens to a word spoken by the fieldworker and then chooses one of the four pictures that best fits the word's meaning. Though the instruction states that child could be tested in their mother tongue, only Vietnamese was used in the conduct of the test. In rounds 2 and 3, there are 204 vocabulary items available for the test, among which a subset of only 76 items are listed in round 4s and 5. According to Leon and

Singh (2017), the selection of items used in round 4 onwards is based on Item Response Theory analysis using data from rounds 2 and 3.[14] Then, instead of administering all the items, they are ranked with increasing difficulty, and the fieldworker needs to establish a "basal" and a "ceiling" for each child first.[15] The items between basal and ceiling will be tested and the child will get score of one if answered correctly and zero otherwise. For the non-administered items below the basal, the child is expected to answer these easier items correctly and thus has a score of one for each of them. On the other hand, the child has a score of zero for the non-administered items above the ceiling. The raw score is the sum of scores of all items.

Because different rounds of the PPVT used different sets of words, we made some adjustments for the PPVT scores in rounds 2 and 3, so that the regression results are comparable across different rounds. Namely, we only calculate the test score based on the 76 items that are available in all rounds. We have also converted the test score to be percent of correctly answered items, ranging from 0 to 100, to make our results readily interpretable. Not surprisingly, the PPVT score as included in the YL dataset and the adjusted score are highly correlated with the correlation coefficient of 0.96 and 0.97 for rounds 2 and 3, respectively.

Appendix B: Supplementary Tables

Tables A1 and A2 provide summary statistics disaggregated by ethnicity and text supply program for the old and young cohorts, respectively. Table A3 provides the details of LSEM estimation results for causal mediation analysis.

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[14] The selection is based on three criteria: (i) adequate item fit in rounds 2 and 3. That is, the proportion of children who answer it correctly is a monotonic function of child's ability; (ii) items without Differential Item Functioning by round and cohort, which means that, after controlling for child's ability, the probability of answering that item correctly does not differ across round and cohort; and (iii) items cover the different level over the range of item difficulty.
[15] The basal and ceiling information is provided in the dataset.

Table 1: Summary statistics for young and old cohorts

	Old Cohort		Young Cohort	
	Age 12	Age 15	Age 12	Age 15
PPVT score (%)	82.86	85.48	76.39	77.78
	(15.82)	(12.86)	(11.10)	(12.71)
Minority	0.13	0.12	0.14	0.15
	(0.33)	(0.33)	(0.35)	(0.36)
Female	0.51	0.51	0.48	0.49
	(0.50)	(0.50)	(0.50)	(0.50)
Father's education in years	7.41	7.40	7.25	7.17
	(3.93)	(3.92)	(3.83)	(3.88)
Mother's education in years	6.76	6.73	6.68	6.59
	(3.81)	(3.78)	(3.73)	(3.78)
Household size	4.91	4.89	4.68	4.69
	(1.37)	(1.37)	(1.51)	(1.53)
Wealth index	0.53	0.61	0.61	0.65
	(0.19)	(0.19)	(0.13)	(0.13)
Rural	0.80	0.81	0.81	0.81
	(0.40)	(0.39)	(0.39)	(0.39)
Textbook supply program coverage	0.61	0.70	0.77	0.66
	(0.49)	(0.46)	(0.42)	(0.47)
Observations	920	914	1,812	1,779
Survey Wave	2	3	4	5

Note: PPVT score is the percent of correct answers, ranging from 0 to 100. Standard deviations in parentheses.

Table 2: DiD estimate of the impact of textbook supply program

Depend var: PPVT score	Old Cohort		Young Cohort	
(% of correct answer)	Age 12	Age 15	Age 12	Age 15
Ethnic minority (M)	-6.217	-3.309**	-14.789***	-15.965***
	(7.412)	(1.534)	(1.997)	(2.189)
Textbook supply program (E)	2.341	3.768**	-0.497	-2.466
	(1.992)	(1.507)	(1.551)	(1.729)
$M \times E$	-2.271	-8.023*	12.069***	10.732***
	(9.596)	(4.005)	(3.687)	(2.895)
Female	-1.079	-0.316	-0.391	0.390
	(0.879)	(0.668)	(0.528)	(0.572)
Father's education in years	0.610***	0.294**	0.333***	0.202*
	(0.123)	(0.136)	(0.076)	(0.104)
Mother's education in years	0.642***	0.188	0.546***	0.492***
	(0.211)	(0.130)	(0.115)	(0.134)
Household size	-1.460***	-0.406	-0.619***	-0.335
	(0.486)	(0.306)	(0.213)	(0.252)
Wealth index	20.952***	20.702***	16.373**	17.819***
	(7.244)	(5.392)	(6.169)	(4.342)
Rural	-0.072	-1.370	2.882	3.705
	(2.092)	(2.487)	(2.032)	(2.224)
Obs.	920	914	1,812	1,779
R^2	0.386	0.367	0.246	0.219

Note: *, **, and *** denote statistical significance at 10, 5, and 1 percent levels, respectively.

Table 3: Mediation Effect Due to Time Use

Ethnic group	Minority				Majority			
Cohort	Young		Old		Young		Old	
Age	12	15	12	15	12	15	12	15
Indirect effect	1.412**	2.828***	-0.399	1.846	0.094*	-0.082	0.114	-0.216
Direct Effect	10.159***	5.800**	6.640	-3.921	-0.335	-2.681***	2.221***	3.794***
Total Effect	11.571***	8.629***	6.241	-2.075	-0.241	-2.763***	2.335***	3.578***
Share of indirect effect	12.30%	32.80%	-5.10%	-25.10%	-12.90%	2.90%	4.90%	-6.10%

Note: Indirect effect represents the average causal mediation effect. *, **, and *** denote statistical significance at 10, 5, and 1 percent levels, respectively. The significance level is obtained based on confidence interval of different level.

Table A1: Summary statistics for the old cohort by ethnicity and presence of text supply program.

| | Old Cohort (Age 12) | | | | | | Old Cohort (Age 15) | | | | | |
| | Ethnicity | | | Textbook Supply Prog | | | Ethnicity | | | Textbook Supply Prog | | |
	Majority	Minority	Diff	No	Yes	Diff	Majority	Minority	Diff	No	Yes	Diff
PPVT score (%)	85.65	63.73	***	83.78	82.27		87.78	68.85	***	86.24	85.15	
	(10.90)	(27.18)		(12.31)	(17.69)		(9.80)	(18.82)		(10.90)	(13.60)	
Female	0.51	0.51		0.51	0.50		0.51	0.50		0.51	0.50	
	(0.50)	(0.50)		(0.50)	(0.50)		(0.50)	(0.50)		(0.50)	(0.50)	
Father's education	8.07	2.92	***	8.08	6.98	***	8.00	3.06	***	8.48	6.94	***
in years	(3.61)	(2.94)		(3.61)	(4.07)		(3.65)	(2.99)		(3.64)	(3.95)	
Mother's education	7.49	1.74	***	7.18	6.49	***	7.43	1.68	***	7.54	6.38	***
in years	(3.39)	(2.56)		(3.53)	(3.96)		(3.37)	(2.51)		(3.55)	(3.82)	
Household size	4.76	5.91	***	4.95	4.88		4.75	5.95	***	4.92	4.88	
	(1.23)	(1.82)		(1.25)	(1.45)		(1.23)	(1.83)		(1.29)	(1.41)	
Wealth index	0.56	0.28	***	0.58	0.49	***	0.64	0.35	***	0.68	0.57	***
	(0.16)	(0.17)		(0.13)	(0.21)		(0.17)	(0.19)		(0.13)	(0.21)	
Rural	0.77	0.98	***	0.73	0.84	***	0.78	0.98	***	0.66	0.87	***
	(0.42)	(0.13)		(0.45)	(0.36)		(0.41)	(0.13)		(0.47)	(0.34)	
Observations	803	117		359	561		803	111		274	640	
Prog coverage (%)	58.03	81.20		0.00	100.00		67.25	90.09		0.00	100.00	

Note: PPVT score is the percent of correct answers, ranging from 0 to 100. Standard deviations in parentheses. Diff columns show the significance level in the test of equality of means with unequal variances. ***, **, * denote that the means s are different at 1, 5, and 10 percent levels, respectively.

Table A2: Summary statistics for the young cohort by ethnicity and presence of text supply program.

|	Young Cohort (Age 12)						Young Cohort (Age 15)					
	Ethnicity			Textbook Supply Prog			Ethnicity			Textbook Supply Prog		
	Majority	Minority	Diff	No	Yes	Diff	Majority	Minority	Diff	No	Yes	Diff
PPVT score (%)	77.98	66.99	***	76.72	76.29		79.77	66.67	***	80.95	76.16	***
	(9.08)	(16.17)		(11.19)	(11.07)		(10.98)	(15.69)		(11.41)	(13.04)	
Female	0.49	0.46		0.52	0.47	*	0.49	0.46		0.48	0.49	
	(0.50)	(0.50)		(0.50)	(0.50)		(0.50)	(0.50)		(0.50)	(0.50)	
Father's education	7.92	3.27	***	7.12	7.29		7.88	3.18	***	7.29	7.10	
in years	(3.49)	(3.32)		(3.62)	(3.89)		(3.52)	(3.31)		(3.37)	(4.11)	
Mother's education	7.44	2.16	***	6.61	6.70		7.39	2.08	***	6.89	6.43	***
in years	(3.27)	(3.05)		(3.46)	(3.81)		(3.31)	(3.02)		(3.16)	(4.06)	
Household size	4.56	5.41	***	4.47	4.74	***	4.56	5.44	***	4.42	4.83	***
	(1.44)	(1.68)		(1.33)	(1.55)		(1.46)	(1.69)		(1.28)	(1.63)	
Wealth index	0.64	0.46	***	0.59	0.62	***	0.68	0.50	***	0.66	0.64	***
	(0.11)	(0.13)		(0.12)	(0.13)		(0.10)	(0.13)		(0.10)	(0.13)	
Rural	0.78	0.99	***	1.00	0.76	***	0.78	0.99	***	1.00	0.71	***
	(0.41)	(0.11)		(0.07)	(0.43)		(0.42)	(0.11)		(0.06)	(0.45)	
Observations	1,550	262		412	1,400		1,509	270		601	1,178	
Prog coverage (%)	74.84	91.60		0.00	100.00		61.70	91.48		0.00	100.00	

Note: PPVT score is the percent of correct answers, ranging from 0 to 100. Standard deviations in parentheses. Diff columns show the significance level in the test of equality of means with unequal variances. ***, **, * denote that the means s are different at 1, 5, and 10 percent levels, respectively.

Table A3: LSEM Estimation Results for Mediation Effect Analysis

Ethnic group	Minority								Majority							
Cohort	Young				Old				Young				Old			
Age	12		15		12		15		12		15		12		15	
Depend vars	Std Time	PPVT	Std Time	PPVT	Std Time	PPVT	Std Time	PPVT	Std Time	PPVT	Std Time	PPVT	Std Time	PPVT	Std Time	PPVT
Study Time		1.014***		1.227***		1.940**		0.633*		0.492***		0.508***		0.749***		0.628***
		(0.296)		(0.206)		(0.809)		(0.380)		(0.127)		(0.075)		(0.207)		(0.089)
Textbook Supply	1.335**	10.090***	2.234***	5.731**	-0.255	6.512	2.748**	-4.050	0.181*	-0.347	-0.175	-2.696***	0.142	2.204***	-0.362	3.778***
Prog	(0.611)	(2.908)	(0.856)	(2.896)	(0.635)	(5.363)	(1.372)	(5.399)	(0.107)	(0.535)	(0.213)	(0.617)	(0.120)	(0.698)	(0.272)	(0.685)
Female	0.419	-1.179	-0.192	-0.928	0.223	0.749	-0.350	0.886	0.244***	-0.378	1.400***	-0.044	0.408***	-1.809***	0.983***	-1.023
	(0.333)	(1.576)	(0.477)	(1.593)	(0.460)	(3.889)	(0.731)	(2.827)	(0.088)	(0.442)	(0.186)	(0.549)	(0.117)	(0.688)	(0.249)	(0.633)
Father's edu in yrs	0.171***	0.252	0.242***	0.553*	0.111	1.029	0.336**	-0.396	0.088***	0.256***	0.179***	-0.011	0.033*	0.561***	0.188***	0.248**
	(0.061)	(0.290)	(0.086)	(0.291)	(0.101)	(0.859)	(0.156)	(0.615)	(0.016)	(0.079)	(0.033)	(0.096)	(0.020)	(0.117)	(0.042)	(0.108)
Mother's educ in yrs	0.050	0.972***	0.191*	-0.184	0.114	2.832***	-0.086	2.231***	0.085***	0.437***	0.256***	0.441***	0.069***	0.450***	0.230***	-0.043
	(0.070)	(0.331)	(0.099)	(0.334)	(0.114)	(0.971)	(0.193)	(0.746)	(0.017)	(0.085)	(0.035)	(0.103)	(0.021)	(0.122)	(0.045)	(0.115)
Household size	0.102	-0.357	-0.002	-0.646	-0.075	-2.512**	-0.642***	0.558	-0.003	-0.501***	-0.178***	-0.082	-0.055	-0.579**	-0.214**	-0.082
	(0.104)	(0.491)	(0.149)	(0.497)	(0.134)	(1.131)	(0.215)	(0.864)	(0.031)	(0.155)	(0.065)	(0.188)	(0.049)	(0.283)	(0.103)	(0.259)
Wealth index	-0.452	48.620***	5.501**	32.910***	1.173	47.865***	5.331**	47.274***	2.430***	5.210**	2.120**	8.469***	2.301***	10.284***	3.685***	10.289***
	(1.575)	(7.427)	(2.143)	(7.245)	(1.559)	(13.192)	(2.266)	(8.980)	(0.461)	(2.326)	(1.046)	(3.035)	(0.459)	(2.715)	(0.967)	(2.449)
Rural	-0.989	8.805	1.096	14.430*	-0.241	15.598	-1.306	1.416	0.739***	1.248*	0.049	2.608***	-1.169***	-1.186	0.593*	-3.370***
	(1.610)	(7.593)	(2.340)	(7.815)	(1.782)	(15.043)	(2.746)	(10.615)	(0.126)	(0.639)	(0.279)	(0.809)	(0.159)	(0.959)	(0.352)	(0.886)
Constant	5.568***	18.891*	-1.519	26.568***	5.369**	25.622	4.239	45.442***	4.728***	66.978***	3.307***	66.913***	6.369***	69.611***	2.323**	75.752***
	(2.088)	(9.981)	(3.023)	(10.098)	(2.136)	(18.550)	(3.443)	(13.390)	(0.381)	(1.998)	(0.915)	(2.661)	(0.408)	(2.716)	(0.922)	(2.324)
Observations	262	262	270	270	117	117	111	111	1,550	1,550	1,509	1,509	803	803	803	803
R-squared	0.082	0.412	0.187	0.338	0.089	0.465	0.215	0.443	0.118	0.092	0.162	0.098	0.245	0.233	0.204	0.203

Note: PPVT score is the percent of correct answers, ranging from 0 to 100. Standard deviations in parentheses. ***, **, * denote that the means s are different at 1, 5, and 10 percent levels, respectively.

Figure 1: Sensitivity Analysis for Mediation Effect Analysis

A: Young Cohort Minority Aged 12

B: Young Cohort Minority Aged 15
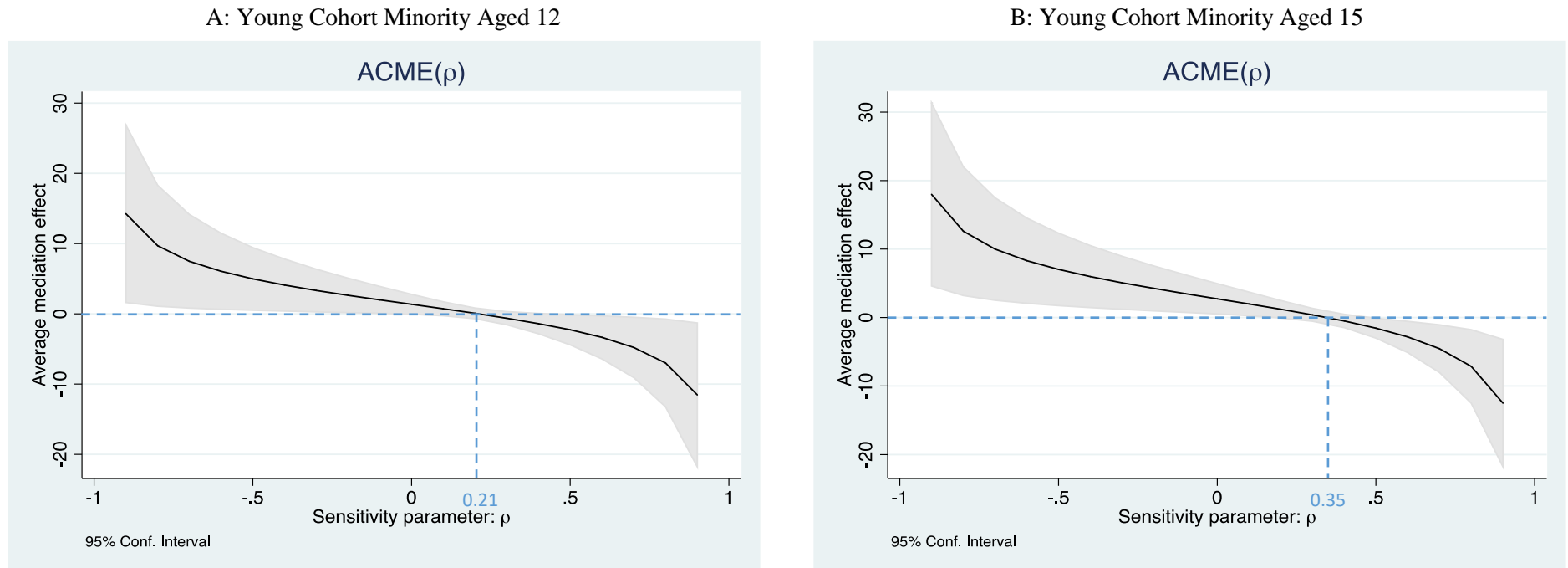
Note: ρ is the correlation between η_i and e_i. The solid line represents the estimated average causal mediation effect (ACME) at different values of ρ, and the shaded regions are the 95 percent confidence interval. In Panel A [B], when ρ=0.21 [0.35], the average mediation effect is driven down to 0 for the young cohort minority group aged 12 [15], respectively.