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From fields to classrooms: Assessing the impact of international crop prices on educational attainments in Brasil

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Abstract

In this study, we show that exposure to high agricultural prices leads to worse educational outcomes in a context with high child labor participation in the agricultural sector. We rely on a reduced form estimation of the shift-share approach on a panel of Brazilian primary and secondary schools. We show that, following an increase in the price of the most important crops, primary schools suffer an increase in the failure rate. High schoolers, on the other hand, tend to drop out of school. We provide evidence that the timing of the price changes matters as well. Students who experience a surge in crop prices during an academically active period are more affected than similar students who experience the same price change during a school break. The effect is heterogeneous across the major regions of Brazil and across ethnic groups.

Contents

1 Introduction

Child labor remains a persistent problem in the world today[1]. The latest global estimates indicate that 160 million children were in child labor globally at the beginning of 2020, accounting for almost 1 in 10 of all children worldwide[2]. Most importantly, global progress against child labor has stagnated since 2016. Seventy percent of all children in child labor are in agriculture, the largest share taking place within families, primarily on family farms.

Given the low skill requirements of agricultural work, it is unsurprising that a large proportion of child workers are found in this sector. However, this very aspect of agricultural work can adversely affect the development of human capital. This is particularly true if children who work in the fields, even for short periods of time, are likely to drop out of school. Many more children struggle to balance the demands of school and work at the same time, which compromises their education.

Child labor is not a problem limited to low-income countries. Developing economies in Latin America, such as Brazil, are examples of middle- and upper-middle-income economies in which the problem persists despite recent economic growth.

We want to study the impact of high agricultural prices on educational outcomes. Much of agricultural production in developing countries is managed by families. In periods of high prices, corresponding to higher returns on crop production, families might rely on their own members, including children, to boost production levels. Child labor is monetarily cheap in the short term—the primary cost being the opportunity cost of a foregone education.

Balancing work in the fields and school activities can result in a higher dropout rate or worsening of academic performance. The effect is likely not homogenous across children's ages. Young children in primary schools, for example, may be less physically able to combine work and study. At the same time, for the same amount of work, they may suffer more in terms of learning efficiency compared to older students. Therefore, we are interested in studying the effect of agricultural price changes on education outcomes for different grades and different cycles of education.

It is important to notice that the influence of rising prices in agricultural commodities on child education is not straightforward. On one hand, an increase in prices might lead children to engage in agricultural work, consequently reducing their school attendance. Conversely, increased production in times of high prices may have a substantial income effect, perhaps inducing families to invest more in their children's education.

However, much of the literature indicates a negative relation between agricultural sector incentives and child education.[3]

The effect of agricultural prices on child labor is studied in Sviatschi (2022), though in her case the commodity is also used for illegal purposes (cocaine production), and the focus is on the effect on the criminal industry-specific human capital. Our research focuses

[1]According to the International Labor Organization (ILO) "The term *child labor* is often defined as work that deprives children of their childhood, their potential and their dignity, and that is harmful to physical and mental development." In particular, child labor interferes with children's schooling.

[2]These estimates are from the most recent report of ILO and UNICEF (2021). The International Labor Organization (ILO) has since 2000 produced estimates on child labor every four years

[3]Lin (2022), Blanchard and Olney (2017)

instead on legal commodities, affecting a broader range of households and potentially exerting a more significant influence on human capital development. While we focus on Brazil, our methodology can be extended to other developing countries.

An extensive body of literature examines the tradeoff between child labor and schooling. Patrinos and Psacharopoulos (1995) show that factors predicting an increase in child labor also predict reduced school attendance and an increased chance of grade repetition. Other educational outcomes might be negatively affected by child labor. For example, Akabayashi and Psacharopoulos (1999) show that hours of work are negatively correlated to reading and mathematical skills. We focus on agricultural prices as factors predicting child labor in the agricultural sector, and study their effect on educational outcomes both in primary and secondary schools. We focus on the dropout rate and on the failure rate, indicating how many students, among those who did not drop out of school, fail the grade they are enrolled in.

Lastly, we intend to study the heterogeneous effects on different age groups, recognizing that the impact on educational attainment may vary significantly based on a child's age. This will help in understanding whether certain age groups are more vulnerable to the negative educational consequences of child labor in the agricultural sector. We also study the effect on students of different ethnic groups, as they can differ substantially in socio-economic status. Finally, we also take into account the heterogeneity of the effect across the major regions of Brazil.

The remainder of the paper is organized as follows. In the next section, we briefly present the institutional context. In section 3, we describe the data. Section 4 presents the empirical strategy, and Section 5 the main results. Section 6 reports robustness checks. Section 7 concludes. All relevant tables and figures not included in the main text are reported in Sections A and B of the Appendix.

2 Context

2.1 Agricultural sector

Brazil is the largest country in terms of arable land. It is a top producer of dozens of crops; among these, soybeans, maize, sugarcane, and rice represent 90% of the country's crop area[4]. Although the agricultural sector accounts for only 6.8% of the largest economy of South America, it is important for both income and employment, especially in the rural areas of the country.[5] In the 2017 agricultural census, almost four million of establishments were classified as family farming, accounting for 77% of all agricultural establishments surveyed and for 23% of the total area of Brazilian agricultural establishments (Nunes et al., 2006).

Given the importance of family-run establishments, child labor in the agricultural sector has been an ongoing issue in Brazil. According to the Instituto Brasileiro de Geografia e Estatística (IBGE), in 2022 Brazil had 1.9 million children and teenagers aged

[4]Global Yield Gap Atlas, https://www.yieldgap.org/Brazil

[5]World Bank national accounts data, https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=BR

between 5 and 17 years (or 4.9% of this age group) in situation of child labor.[6] Among children and teenagers in situation of child labor in 2022, 23.9% were aged between 5 and 13 years, 23.6%, between 14 and 15 years, and 52.5%, between 16 and 17 years. Child labor is prevalent among male children, accounting for 65.1% of children in this situation. The phenomenon is also heterogeneous across ethnic groups, affecting predominantly black and brown people.

2.2 Education in Brazil

The education system in Brazil offers free and compulsory education at primary (ages 7-14) and secondary (ages 15-17) levels. Basic education consists of elementary school and high school. The first is further split into two cycles: *Ensino Fundamental I* (years 1-5) and *Ensino Fundamental II* (years 6-9). High school lasts for three additional years.

Ensino Fundamental I focuses on foundational skills in reading, writing, and mathematics, alongside introductory science, history, geography, arts, and physical education. This stage aims to provide a broad base of knowledge and essential skills to support further learning and personal development. Students are usually assisted by a single teacher.

Ensino Fundamental II builds on this foundation, offering more specialized instruction in subjects such as advanced mathematics, sciences (biology, physics, chemistry), history, geography, Portuguese language, and a foreign language (usually English or Spanish). This stage is designed to deepen students' understanding of various disciplines and prepare them for the challenges of high school. There are as many teachers as subjects

High school (*Ensino Médio*) in Brazil is more specialized and aims to prepare students for higher education and the job market. The curriculum includes core subjects such as Portuguese, mathematics, natural sciences, humanities, and physical education. Additionally, students may have the opportunity to choose elective courses or focus areas, depending on their interests and career aspirations.

3 Data

3.1 Education data

The main dataset consists of a panel of Brazilian primary and secondary schools covering fifteen years, from 2007 to 2021. The data on schools is taken from Censo Escolar.[7] This dataset contains information on the school (e.g. if it is rural or urban, public or private). To the data from Censo Escolar, we add data on educational outcomes that we took from the Educational Indicators section of the Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (Inep).[8] This dataset contains the outcomes of interest, specifically, approval, dropout and failure rate. They are available for different grades in

[6]IBGE Agency News, https://agenciadenoticias.ibge.gov.br/en/agencia-news/2184-news-agency/news/38703-child-labor-increased-in-brazil-between-2019-and-2022

[7]Censo Escolar data available at https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados/censo-escolar

[8]Educational Indicators' data available at https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/indicadores-educacionais/taxas-de-rendimento-escolar

Figure 1: Primary and secondary school distribution

primary and secondary schools. Therefore, we cover the twelve grades that children go through, starting at the age of five or six.

We also have information on the number of students in each school for each year by ethnic groups. We use this data to study the heterogeneous effect on different minorities in Brazil. Unfortunately, schools do not report educational outcomes by ethnicity, so we focus on the shares of students belonging to each ethnic group and how these shares are affected by agricultural prices.

From Censo Escolar, we also take the address of each school, allowing us to geocode most primary and secondary schools in Brazil. Figure 1 shows the location of schools in Brazil that are used in our analysis. We can see a higher concentration of schools along the coast and in the south, the most populated areas of the country.

3.2 International Prices

From the World Bank Monthly Commodity Price Data, we take four time series: international prices in U.S. dollars for soy, sugar, maize, and rice. We focus on these four crops, as together they account for over 90% of the crop area in Brazil. To use these prices in our analysis, we convert them into Brazilian Real.

3.3 Crop suitability

Crop suitability data is crucial to constructing our Bartik-type instrument. Suitability plays the role of the shares that weight the change in international prices, which is common across schools. Therefore, we need to construct a crop-specific suitability index for each

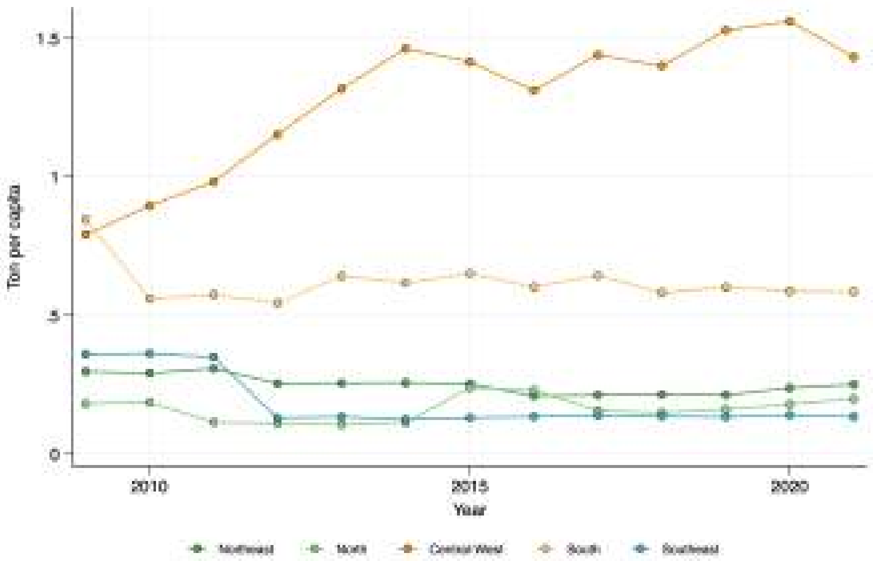

Figure 2: Agricultural Production Per Capita

school of Brazil.

For this, we take the suitability indexes for the different crops from the FAO Global Agro-Ecological Zones (GAEZ) database. This is very precise raster data at 5 arc-minutes resolution, which approximately corresponds to an area of $9km^2$. We can geocode each school in Brazil using the address provided in Censo Escolar. It is then possible to compute the average crop-specific suitability index in the area around each school. We use a radius of $10km$. Figures B1, B2, B3, and B4 show the same schools as in Figure 1 and their associated suitability index for the four main crops in Brazil.

3.4 Agricultural production

The Instituto Brasileiro de Geografia e Estatística (IBGE) conducts the Municipal Agricultural Production (PAM) survey, gathering data on agricultural production at the municipal level. This survey provides details on the planted area, area to be harvested, harvested area, amount produced, and average yield for over sixty agricultural products in the reference year. Conducted annually, PAM covers the entire national territory. Municipal information for each product is included only if there is at least one hectare of land planted with the product and a minimum production of one metric ton.

The agricultural sector is relevant in all of Brazil, with some regional heterogeneity. In Figure 2 we report the total agricultural production per capita, considering the crops of interest in our analysis (soybeans, maize, sugarcane, and rice) for the five macro-regions of Brazil. In Figures B5, B6, B7, and B8 we report the agricultural production per capita for each of the four crops of interest.

4 Empirical Strategy

4.1 Main specification

Our empirical strategy relies on the reduced form estimation of the shift-share approach. Similar approaches are followed in Sviatschi (2022) and Dube and Vargas (2013). However, the work that most resembles our approach is Maffioli (2023). For each school in Brazil, we construct an annual agricultural index by interacting international crop prices with school-specific suitability indexes for the same crops. Given that we are using prices of different crops, and to ease comparison, we then standardize such an index by subtracting the mean and dividing by its standard deviation.

A classic shift-share instrumental variable (SSIV) is a weighted sum of a common shock, also called the shift. The shares are the weights reflecting the heterogeneous exposure to the common shock.

In our case, the common shock is given by the change in international crop prices, while the suitability indexes represent the shares. The changes in prices are common across schools by construction. However, each school's educational outcomes will depend not only on the incentive for crop production, but on the potential of the surrounding land to host that production. By interacting prices with suitability indexes, we are controlling for this potential. The suitability of the area surrounding a school measures the exposure of the school to the shock in international prices.

Identification in a reduced form framework with SSIV can come from two alternative sources: the exposures shares or the shocks. Our main specification relies on the second. Borusyak et al. (2022) shows that identification can be achieved under quasi-random assignment of shocks. Therefore, we argue that changes in the international prices represent a time-series of exogenous shocks. Under this framework, the suitability indexes are allowed to be endogenous.

We provide suggestive evidence that we can indeed assume international prices as exogenous to the local dynamics in Table 1. Most municipalities are very small producer on the global scale, and are unlikely to affect international prices. In a robustness check, we drop observations coming from municipalities that are major producers.

Table 1: Agricultural Output as % of World Supply

Crop	Soy	Maize	Sugar	Rice
1st Municipality				
% BRA	2.77%	2.08%	1.25%	4.94%
% WLD	0.66%	0.15%	0.38%	0.1%
Avg. Municipality				
% BRA	0.04%	0.02%	0.02%	0.03%
% WLD	0.01%	0.00%	0.01%	0.00%

Notes: We report agricultural output measured in metric tons as a percentage of Brazil's and the world's supply. This statistic is reported for both the largest producing municipality and the average producing municipality for each specific crop.

Our empirical strategy allows us to use continuous time variation in international prices and continuous cross-sectional variation in the suitability index. Our main specification is the following:

$$E_{st} = \alpha_s + \phi_t + \sigma_{mt} + \theta \boldsymbol{P}_t \times \boldsymbol{Suit}_s + \epsilon_{st} \tag{1}$$

where α_s and ϕ_t are school and time fixed effects, σ_{mt} are municipality-by-time fixed effects and $\boldsymbol{P}_t \times \boldsymbol{Suit}_s$ is our SSIV.

We construct our standardized instrument considering the four most important crops of Brazil:

$$\boldsymbol{P}_t \times \boldsymbol{Suit}_s = \sum_{c \in \mathcal{C}} P_{tc} \times Suit_{sc} \tag{2}$$

where $\mathcal{C}$ is the set of crops, P_{tc} is the price of crop c at time t, and $Suit_{sc}$ is the suitability index of school s for crop c. The coefficient of interest, θ, gives the change in percentage points in the educational rate of interest, given a one standard deviation change in the instrument.

Note that (1) is the reduced form of a structural relationship that illustrates the trade-off bewteen education and work in the agricultural sector:

$$E_{st} = \alpha_s + \phi_t + \sigma_{mt} + \theta_1 Q_{st} + \nu_{st}$$
$$Q_{st} = \alpha_s + \phi_t + \sigma_{mt} + \theta \boldsymbol{P}_t \times \boldsymbol{Suit}_s + \xi_{st}$$

Where Q_{st} is the standardized per capita agricultural output in year t in the area surrounding school s. In this framework, the agricultural activity, captured by Q_{st}, is instrumented by $\boldsymbol{P}_t \times \boldsymbol{Suit}_s$ to isolate the exogenous variation of agricultural production coming from changes in international prices.

Note that data on agricultural production is available only at the municipality level. Therefore, if we wanted to estimate the previous set of equations we would use Q_{mt} (standardized per capita agricultural production in municipality m in year t) and without municipality-by-time fixed effect due to collinearity.

4.2 Controlling for local characteristics

The main specification presented in 4.1 relied on the exogeneity of the international crop prices, as Borusyak et al. (2022) showed that is sufficient for identification. For this reason, we do not impose an exogeneity restriction on the crop suitability. However, recognizing that suitability can be correlated to local characteristics, that are themselves possibly correlated with the outcome of interest, we present a second specification in which we control for such characteristics. Therefore, in the following specification, we rely on the plausible exogeneity of the suitability conditional on local characteristics.

We take covariates at the municipality level from the Brazilian census of 2000 and interact them with time fixed effects. In this way, we are allowing these characteristics

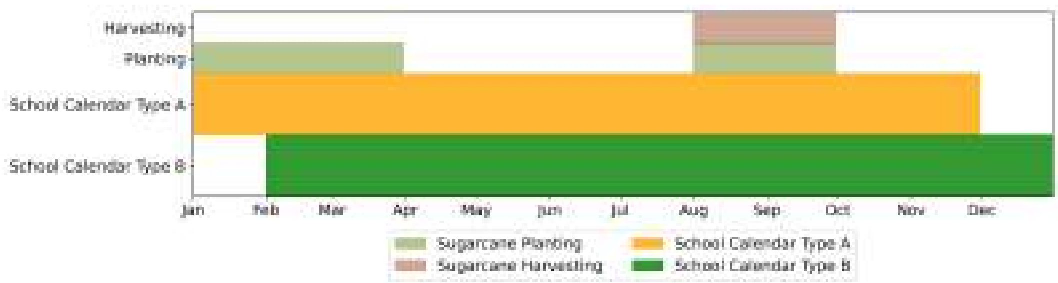

Figure 3: Timeline of sugarcane production and academic calendar

to have flexible effects on the outcomes over time, and, at the same time, we avoid the bad control problem that would have arisen if we controlled for contemporaneous characteristics. Therefore, we run the following specification:

$$E_{st} = \alpha_s + \phi_t + \sigma_{mt} + \theta \boldsymbol{P_t} \times \boldsymbol{Suit_s} + \boldsymbol{X}_{m,2000} \times \gamma_t + \epsilon_{st} \tag{3}$$

This specification is more attractive in a framework in which the time-series shocks are thought to be endogenous to local condition (Goldsmith-Pinkham et al., 2020).

4.3 Academic calendar

Work in the fields can be compatible with normal educational outcomes. This is true not only in less labor-intensive periods, when the workload can be managed by farmers with little help from their children, but also during labor-intensive periods like planting and harvesting if they coincide with school breaks or holidays.

Therefore, we now want to understand whether the timing of the price change matters for educational outcomes. By timing, we refer to whether the price change realizes in an academically active period or not.

In order to do so, we focus on the state of São Paulo. São Paulo is a major producer of sugarcane, and for many municipalities this is the only crop produced. Therefore, we can focus on the price and on the production cycle of this crop.

Although they have to abide with some common rules, Brazilian schools have some flexibility in deciding the starting and ending date of the school calendar. In the state of São Paulo, this results in 20% of the schools starting in January, and the remaining 80% in February. This seemingly irrelevant difference in the timing of academic activities is actually made important by the labor-intensive summer planting season of sugarcane, which starts in January. This means that children have different exposure to labor-intensive periods throughout their school activity depending on which type of school they attend in São Paulo. Figure 3 represents visually this plausibly exogenous heterogeneity in the exposure to the planting season based on school type.

The importance of focusing on the state of São Paulo, where the production of sugarcane is predominant, is that we can focus on the production cycle of this crop. Therefore, can estimate the following specification:

$$E_{st} = \alpha_s + \phi_t + \sigma_{mt} + \theta_1 \; P^{Jan}_{t,sug} \times Suit_{s,sug} + \theta_2 \; Jan \times P^{Jan}_{t,sug} \times Suit_{s,sug} + \epsilon_{st} \qquad (4)$$

where α_s, ϕ_t, and σ_{mt} are, respectively, school, time, and municipality-by-time fixed effects. $P^{Jan}_{t,sug}$ is the January price of sugarcane, while $Suit_{s,sug}$ is the school-level suitability for sugarcane production. Finally, Jan is a dummy variable equal to one for schools that start in January. The coefficient of interest is θ_2, which represents the additional effect of sugarcane prices on educational outcome for school starting in January with respect to school starting in February.

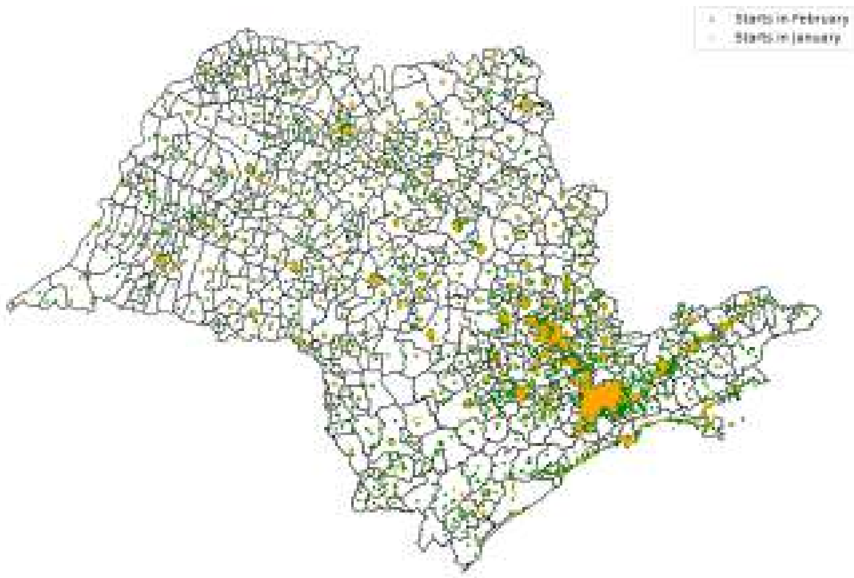

Figure 4: Schools in São Paulo by academic calendar

The price in January is arguably not a perfect measure of the incentive to plant sugarcane in January, as planting decisions could be taken in advance and the persistence of the price increase also matters. However, as long the price of January is as good of a proxy for farmers whose children go to schools starting in January as for farmers whose children start school in February, the estimation is valid.

Important differences between schools depending on their calendar will be captured by school fixed effects. Figure 4 shows the distribution within the state of São Paulo of schools depending on their calendar type. We can see that both type of schools are spread homogeneously in the state.

4.4 Heterogeneity

4.4.1 Regional heterogeneity

Given the vast geographical heterogeneity of Brazil, we want to get some insights into the heterogeneity of the effect of agricultural prices on educational outcomes. Geographically, Brazil is divided into five major regions: North, Northeast, Central-West, South and Southeast.

Table 2: Educational Outcomes by Region

	Primary School				Secondary School	
	Elementary School		Middle School		High School	
Region	Dropout	Failure	Dropout	Failure	Dropout	Failure
Norteast	2.85	7.58	3.99	9.64	8.89	8.21
North	4.96	7.86	5.32	10.39	9.87	8.06
Central-West	1.17	5.08	2.09	6.68	6.23	10.12
South	0.57	5.65	1.13	9.52	6.13	10.84
Southeast	0.77	4.40	1.28	6.02	4.43	8.53
Brazil	1.97	6.15	2.65	8.38	6.31	8.96

Notes: educational rates are measured from 0 to 100. We report averages for the different cycles of basic education, which includes primary and secondary school. Primary school is divided in five years of elementary school and four years of middle school. Secondary school corresponds to high school, which lasts for three years.

In table 2, we report the main educational outcomes for the regions of Brazil. The North of Brazil display particularly worse educational outcomes. Dropout rates are 150% higher than the national average for elementary school, 100% higher for middle school, and 56% higher for high school. Northeastern rates are somewhat lower, but still higher than the national average. The Central-West region is probably the most representative of the country, while the south of Brazil has lower dropout and failure rates. In all the regions, there is a general trend in which older children suffer higher dropout and failure rates.

4.4.2 Ethnic heterogeneity

Due to its history, Brazil is rich in ethnic diversity. From descendants of European settlers and African slaves from West Africa to Indigenous people and descendants of the most recent East Asian immigrants. These groups differ not only in history and tradition, but also in socio-economic status. Therefore, it is important to study how different communities are affected. Unfortunately, schools in Censo Escolar do not report the educational outcomes by ethnic group. However, they report the number of students by ethnic group. In particular, they report the following groups: *branca* (white), *parda* (multiracial), *preta* (black), *amarela* (asian) and *indígena* (indigenous). Therefore, while we do not have a measure of the dropout rate, we can check how agricultural prices affect the shares of students belonging to each ethnic group.

We estimate the following specification:

$$Share_{est+1} = \alpha_s + \phi_t + \sigma_{mt} + \theta \boldsymbol{P_t} \times \boldsymbol{Suit_s} + \epsilon_{st} \quad (5)$$

where $Share_{est+1}$ is the share of students in school s belonging to ethnic group e in year $t+1$, α_s and ϕ_t are school and time fixed effects, σ_{mt} are municipality-by-time fixed effects and $\boldsymbol{P}_t \times \boldsymbol{Suit}_s$ is our SSIV.

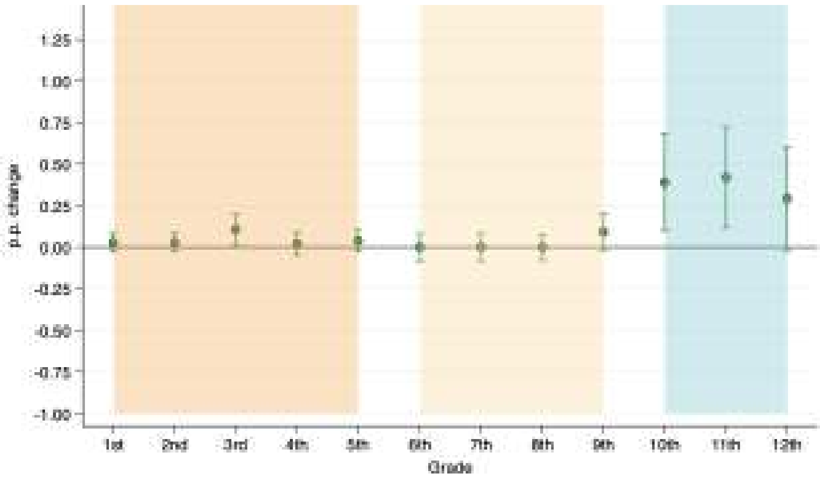

Figure 5: Dropout rate for primary and secondary schools

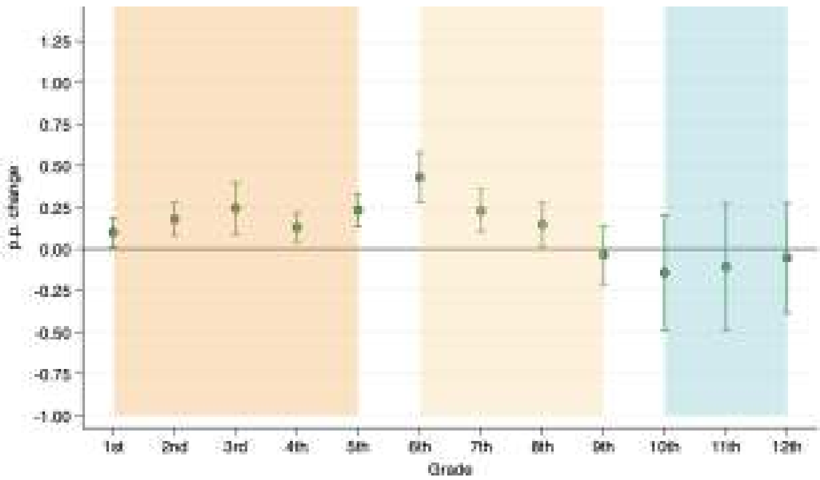

Figure 6: Failure rate for primary and secondary schools

5 Results

5.1 Effect for primary and secondary schools

We now present our findings from our main specification (1) in Figures 5 and 6. We also report the same results in Tables A1, A2, A16, and A17 . We found different patterns for primary and secondary schools. For primary schools, following an increase in agricultural prices, students do not drop out of school, but there is a significant increase in the failure rate, indicating worse academic performance.

For secondary schools, on the other hand, we have a significant increase in the dropout rate. This increase is especially relevant in the first years of high school and declines as graduation approaches. We also see that the failure rate does not change significantly. However, when considering these results, it is important to interpret them together with the increased dropout rate. It is likely that there is a positive correlation between the probability of dropping out of high school following an increase in agricultural prices and a higher expected probability of failure. If this is the case, there is a selection in the high schoolers who stay in school following increased agricultural prices, partially explaining the absence of an effect in the failure rate.

5.2 Controlling for local characteristics

The results are robust when we include local characteristics interacted with time fixed effects, as in (3). In Figures B9 and B10 we see again primary schools facing higher failure rates, while secondary schools display an increased dropout rate, but not a significant change in the failure rate. The same results are reported in Tables A3, A4, A18, and A19.

5.3 Academic calendar

After having documented the presence of an effect of agricultural prices on educational outcomes, we now turn to studying how important the timing of the price changes are. We present the results from (4) in Tables 3 and 4.

Table 3: Dropout rate for secondary schools

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
January=1 × Jan. Sug. Instr.	0.455***	0.419***	0.257***
	(0.0278)	(0.0328)	(0.0307)
Jan. Sug. Instr.	0.335	0.514*	0.421
	(0.222)	(0.250)	(0.218)
Mean	3.230	3.609	3.094
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.576	0.559	0.517
Observations	51937	50716	49882

Notes: Robust standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4: Failure rate for primary schools

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
January=1 × Jan. Sug. Instr.	0.149***	0.172***	0.139***	0.193***	0.264***	0.237***	0.227***	0.246***	0.721***
	(0.0237)	(0.0161)	(0.0335)	(0.0168)	(0.0222)	(0.0343)	(0.0242)	(0.0248)	(0.0460)
Jan. Sug. Instr.	0.0400	0.0576	0.121	0.255***	0.0469	0.249	0.250	0.209	-0.512*
	(0.113)	(0.0798)	(0.174)	(0.0746)	(0.115)	(0.161)	(0.142)	(0.123)	(0.205)
Mean	3.004	2.010	4.472	0.950	1.885	3.721	2.026	2.389	4.822
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.613	0.670	0.649	0.526	0.598	0.610	0.642	0.558	0.550
Observations	112517	92068	75958	86939	86829	82360	81138	80340	69980

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar. *January* indicates schools that start in January. *Jan. Sug. Instr.* is the SSIV constructed with January sugarcane prices and suitability for sugarcane production.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

We can see that secondary schools starting in January display a statistically significant increase in dropout rate compared to secondary schools that start in February. At the same time, primary schools starting in January have higher failure rates associated with higher January prices.

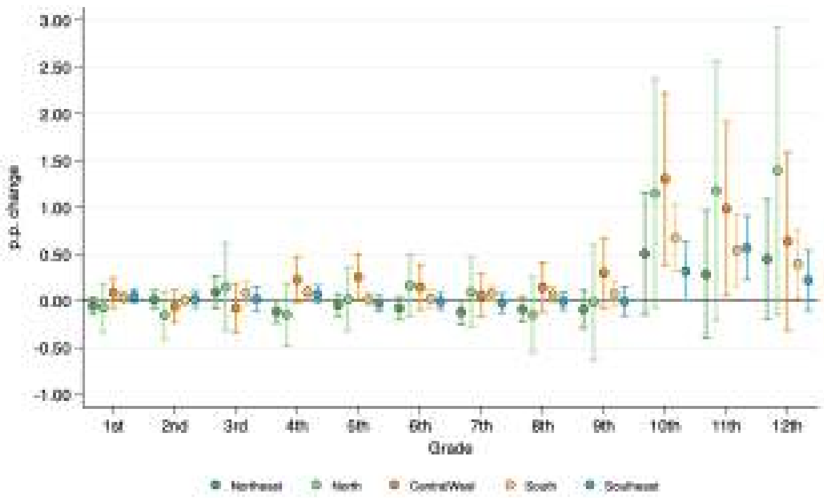

Figure 7: Effect on dropout rate for five macro-regions

Together, these results tell us that the timing of the price changes are significant in affecting educational outcomes. If higher prices represent an incentive to increase production, partially relying on the work of minors, their education will suffer more if during the labor-intensive period they also have to manage academic activities.

5.4 Heterogeneity

5.4.1 Regional heterogeneity

We now turn to the results of the analysis presented in section 4.4.1.[9] Figure 7 and 8 show the change in percentage points in, respectively, the dropout and the failure rate associated with a one standard deviation increase in the SSIV across the five macro-regions of Brazil. As in the previous specifications (1) and (3), the effect on the dropout rate is concentrated in grades 10 to 12, corresponding to high school. The most affected regions are the Central-West and the South.

The same applies for the failure rate, primary schools are affected mostly in Central-West and South regions. In most regions, we do not find a significant effect in the failure rate for high schools, in line with the previous findings. However, high schools in the Central-West region display a decrease in the failure rate. This could be due to the important selection channel due to the increased dropout rate.

Therefore, we find evidence consistent with the statistics reported in Figure 2. The most affected regions are the ones with higher agricultural production per capita. This is a critical result, as one could expect the most affected regions to be the North and Northeast of Brazil. These are the regions with worse educational outcomes, as reported in Table 2, lower GDP per capita, and a higher share of the population living in rural areas.[10] Despite this, the most affected regions are those where the agricultural sector, so relevant for child labor, is prevalent. This evidence is consistent with the recent trends in

[9]The results are also reported in Tables A6-A15 for primary schools and A21-A30 for secondary schools.

[10]The share of residents living in rural areas for the Northeast, North, Central-West, South, and Southeast regions are, respectively, 39.68%, 42.51%, 16.41%, 24.23%, and 14.90%

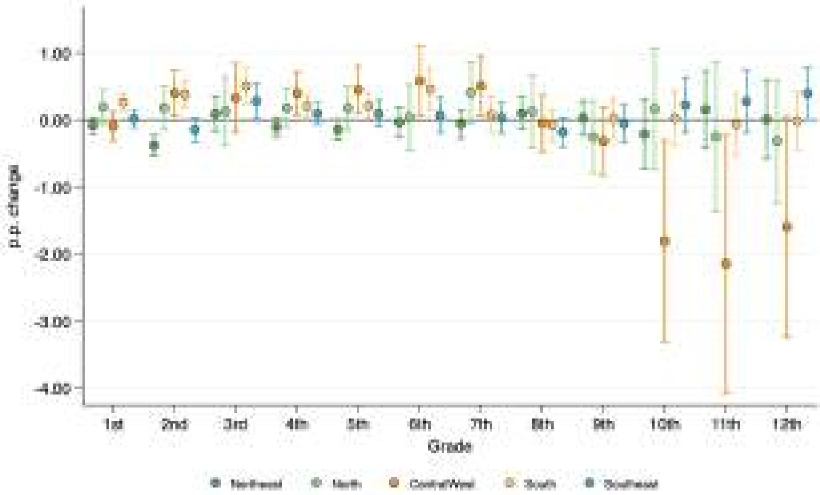

Figure 8: Effect on failure rate for five macro-regions

child labor in growing middle- and upper-middle-income economies.

5.4.2 Ethnic heterogeneity

The results presented so far mask heterogeneous effect for different type of students. By estimating (5) we gain some insights into the effect depending on one particular characteristic of students: their ethnicity. The results are in Table 5. The estimates indicate the percentage points change in the share of students of a specific ethnicity in the year following a standard deviation increase in the SSIV.

Table 5: Dropout rate for secondary schools

	(1) White	(2) Black	(3) Mixed	(4) Asian	(5) Indigenous	(6) Other
Bartik Instr.	1.012***	-0.117*	-0.785***	-0.0694**	-0.198**	0.157
	(0.229)	(0.0587)	(0.237)	(0.0241)	(0.0631)	(0.358)
Mean	35.55	2.771	26.55	0.473	1.251	33.40
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.940	0.864	0.921	0.737	0.982	0.856
Observations	196293	196293	196293	196293	196293	196293

Notes: Robust standard errors in parentheses. The group share is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the share of student belonging to the specific ethnic group given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting the number of students by ethnicity in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

We see that white students increase their share by 1p.p., while all other ethnicities see their share decline. The most affected are ethnically mixed students, followed by indigenous and black. These results are consistent with white persons in Brazil being in a generally better socio-economic condition.

6 Robustness

6.1 Top producers

The main identification assumption in the empirical strategy presented in section 4.1 is the exogeneity of changes in international prices. This assumption is credible given the small size in production terms of Brazilian municipalities on a global scale, documented in table 1.

Still, to alleviate the concern that the largest producers in Brazil do influence international prices, and that this in turn affects our estimates, we estimate (3) excluding from the analysis the top 5% of municipalities by agricultural production. The results are reported in Tables 6 and 7. The results are significant and consistent in magnitude with the ones from the main specification for both primary and secondary schools. In both cases, the size of the effect is slightly larger when excluding the top producers, indicating that in the municipalities with a larger agricultural output there might be a relevant income effect that biases the estimates towards zero.

Table 6: Dropout rate at secondary schools

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.510***	0.515**	0.554***
	(0.152)	(0.158)	(0.168)
Mean Outcome	7.367	7.521	5.990
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.722	0.677	0.632
Observations	183164	177965	173781

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 7: Failure rate for primary schools

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	0.345***	0.329***	0.542**	0.255**	0.145	1.188***	0.215	0.305*	0.579*
	(0.0958)	(0.0889)	(0.181)	(0.0837)	(0.125)	(0.171)	(0.121)	(0.130)	(0.259)
Mean Outcome	3.515	2.576	5.759	1.465	1.741	4.263	2.410	2.574	5.496
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.627	0.610	0.622	0.508	0.456	0.603	0.576	0.484	0.546
Observations	899596	876771	590644	817152	814148	691833	680945	660254	427193

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.2 Lagged prices

In the main specification presented in section 4.1 we consider the effect on educational outcomes of contemporaneous prices, that is, prices which are a yearly average for the same calendar year in which educational outcomes are recorded.

We can do this as we focus on short-term educational outcomes and because the academic calendar in Brazil usually runs from February to December, and therefore the average yearly price is the relevant one.

However, to account for a possible effect given by past prices, we include lagged prices and estimate the following specification:

$$E_{st} = \alpha_s + \phi_t + \sigma_{mt} + \theta_1 \boldsymbol{P_t} \times \boldsymbol{Suit_s} + \theta_2 \boldsymbol{P_{t-1}} \times \boldsymbol{Suit_s} + \boldsymbol{X}_{m,2000} \times \gamma_t + \epsilon_{st} \tag{6}$$

Table 8: Dropout rate at secondary schools

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.734*	1.092**	0.829*
	(0.356)	(0.386)	(0.348)
L.Bartik Instr.	-0.251	-0.591	-0.298
	(0.518)	(0.554)	(0.504)
Mean Outcome	7.850	8.314	6.638
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.738	0.698	0.659
Observations	197743	192520	189047

Notes: Robust standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 9: Failure rate at primary schools

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	0.259**	0.368**	0.283	0.258*	0.230*	0.247	0.374**	-0.0722	0.273
	(0.0920)	(0.113)	(0.161)	(0.105)	(0.113)	(0.164)	(0.145)	(0.147)	(0.200)
L.Bartik Instr.	-0.286*	-0.335	-0.106	-0.250	-0.168	0.212	-0.335	0.375	-0.420
	(0.142)	(0.176)	(0.250)	(0.166)	(0.182)	(0.252)	(0.226)	(0.233)	(0.310)
Mean Outcome	6.351	6.066	9.867	2.867	4.013	9.402	7.110	6.665	10.44
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.719	0.696	0.694	0.617	0.614	0.697	0.671	0.604	0.665
Observations	962650	893082	579358	827048	829888	740326	730352	709943	453848

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar. L.Bartik Instr. is the lagged SSIV.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The results are provided in Tables 8 and 9. Regarding secondary schools, a standard deviation increase in our instrument leads to an increase of 0.7-1 percentage points in the dropout rate. The lagged prices, on the other hand, are not significant. The results for primary schools are also consistent with the main specification.

6.3 Lagged outcomes

An effect on this year dropout/rejection rate will have consequences on the next year dropout/rejection rate, as the composition of the classes change. Therefore, past educational outcome can be a time-varying confounding variable that cannot be incorporated in unit fixed effects.

We could be tempted to simply control by the lagged outcome, as in a lagged dependent variable model. However, given that we also model unobserved time-invariant heterogeneity in the form of unit fixed effects, the resulting estimation would be biased, as first noted by Nickell (1981). This is because when taking first differences to kill the unit fixed effects we create correlation between the lagged outcome, ΔE_{st-1}, and the error term, $\Delta\epsilon_{st}$, both correlated with ϵ_{st-1}.

Effectively, by including the lagged outcome in our model, we have a dynamic panel with "small T, large N", a linear functional relationship, one left-hand variable that is dynamic, depending on its own past realizations, and fixed individual effects, implying unobserved heterogeneity. Therefore, we apply the Arellano-Bond estimator (Arellano and Bond, 1991) under the assumption of no serial correlation in the error terms. The idea is to use past lags of the dependent variable as instruments for the first difference of the first lag of the dependent variable. In this framework, we allow the SSIV as well to be not fully exogenous, and we instrument it with past lags. The results are presented in tables 10 and 11. The results for the dropout rate at secondary schools lose some significance, but an effect persists in the first year of high school. The results for primary schools are more robust, with a standard deviation increase in the instrument being associated with a 0.27-2.1 percentage points increase in the failure rate.

Table 10: Dropout rate at secondary schools

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.440***	0.192	-0.0328
	(0.117)	(0.144)	(0.126)
L.Bartik Instr.	-0.699***	0.855***	-0.330
	(0.171)	(0.212)	(0.184)
Lagged Outcome	0.358***	0.326***	0.254***
	(0.00298)	(0.00346)	(0.00344)
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	197744	190780	186893

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar. L.Bartik Instr. is the lagged SSIV.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 11: Failure rate at primary schools

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	1.255***	1.283***	1.906***	0.569***	0.268**	1.440***	1.494***	1.226***	2.098***
	(0.0651)	(0.0872)	(0.125)	(0.0849)	(0.101)	(0.138)	(0.130)	(0.129)	(0.134)
L.Bartik Instr.	-0.680***	-0.498***	-1.567***	-0.827***	-0.447**	-0.467*	-0.584**	-0.821***	-0.368
	(0.0963)	(0.129)	(0.188)	(0.125)	(0.148)	(0.209)	(0.197)	(0.196)	(0.201)
Lagged Outcome	0.289***	0.239***	0.290***	0.197***	0.221***	0.253***	0.234***	0.207***	0.349***
	(0.00148)	(0.00126)	(0.00236)	(0.00141)	(0.00157)	(0.00199)	(0.00200)	(0.00207)	(0.00244)
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	765790	733923	416297	629634	637840	536209	525168	503168	377080

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar. L.Bartik Instr. is the lagged SSIV.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

7 Conclusion

This paper provides evidence that exposure to high agricultural prices leads to worse educational outcomes in a context of high child labor presence in the agricultural sector. The effect is pronounced in primary schools, which suffer an increase in the failure rate. There is evidence that high schooler drop out more following an increase in prices, possibly turning to full-time work in the fields.

The timing of the change in prices also matters. In the state of São Paulo, higher sugarcane prices have a larger negative effect on the educational outcomes of the students who are academically active during the labor-intensive planting period compared to otherwise similar students who experience the same price change during a school break.

We studied the heterogeneity of the effect across the major regions of Brazil. The effect on both dropout and failure rate is higher in the Central-West and South regions of Brazil. This is likely due to the prevalence of the labor-intensive agricultural sector in this region. Our findings are consistent with recent trends in child labor in growing middle- and upper-middle-income economies.

The effect is also heterogeneous across students of different ethnic groups. Higher agricultural prices are associated with an increase in the share of white students enrolled, and a decline in the shares of black, mixed, asian, and indigenous students.

These findings contribute to the literature on child labor in the agricultural sectors of developing countries and its consequences on education. Even during economic growth, and perhaps due to the profitability of crop production, child labor extends beyond poor rural areas. In this paper, we focused on short-term effects, but further research is needed to understand the long-lasting effects on human capital development.

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A Tables

A.1 Effects for primary schools

A.1.1 Main specification

Table A1: Dropout rate at primary schools

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
Bartik Instr.	0.0278	0.0286	0.106*	0.0211	0.0388	0.000230	0.00107	-0.00109	0.0914
	(0.0283)	(0.0287)	(0.0467)	(0.0343)	(0.0318)	(0.0422)	(0.0422)	(0.0400)	(0.0563)
Mean Outcome	1.986	1.435	2.570	1.338	1.277	2.177	2.126	2.282	3.398
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.558	0.527	0.594	0.411	0.441	0.641	0.608	0.592	0.595
Observations	1090781	1043309	708455	972935	970180	836960	823471	799699	527299

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A2: Failure rate at primary schools

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	0.0995*	0.179***	0.246**	0.129**	0.233***	0.430***	0.229***	0.147*	-0.0357
	(0.0449)	(0.0493)	(0.0784)	(0.0426)	(0.0496)	(0.0752)	(0.0657)	(0.0668)	(0.0895)
Mean Outcome	6.394	6.269	10.05	3.354	4.315	9.877	7.710	7.147	10.53
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.700	0.685	0.676	0.602	0.595	0.698	0.674	0.608	0.646
Observations	1090781	1043309	708455	972935	970180	836960	823471	799699	527299

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.1.2 Controlling for local characteristics

Table A3: Dropout rate for primary schools

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
Bartik Instr.	0.0434	0.0350	0.144**	0.0255	0.0504	0.0152	0.0109	0.00659	0.131*
	(0.0281)	(0.0287)	(0.0471)	(0.0342)	(0.0316)	(0.0427)	(0.0415)	(0.0397)	(0.0564)
Mean Outcome	2.030	1.470	2.658	1.359	1.309	2.208	2.162	2.324	3.474
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.561	0.529	0.597	0.414	0.442	0.647	0.611	0.594	0.597
Observations	1024351	985029	662598	917288	914766	785926	773380	750919	488533

Notes: Robust standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A4: Failure rate for primary schools

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	0.0981*	0.119*	0.260***	0.117**	0.154**	0.395***	0.154*	0.104	-0.0809
	(0.0457)	(0.0499)	(0.0785)	(0.0435)	(0.0477)	(0.0743)	(0.0644)	(0.0661)	(0.0895)
Mean Outcome	6.416	6.344	10.07	3.335	4.376	9.838	7.670	7.150	10.52
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.704	0.685	0.679	0.608	0.598	0.699	0.674	0.607	0.649
Observations	1024351	985029	662598	917288	914766	785926	773380	750919	488533

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.1.3 Academic calendar

Table A5: Dropout rate for primary schools

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
January=1 × Jan. Sug. Instr.	0.0636***	-0.0101*	0.0767***	-0.0269***	-0.0157*	0.000574	0.00921	0.0481***	0.220***
	(0.00785)	(0.00439)	(0.0119)	(0.00734)	(0.00645)	(0.00620)	(0.00568)	(0.00686)	(0.0146)
Jan. Sug. Instr.	0.0330	0.0175	0.105	-0.0274	-0.0499	0.0146	-0.0215	0.0552	-0.0152
	(0.0446)	(0.0447)	(0.0657)	(0.0659)	(0.0397)	(0.0473)	(0.0452)	(0.0493)	(0.0826)
Mean	0.751	0.240	1.022	0.302	0.207	0.356	0.377	0.457	1.073
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.539	0.383	0.528	0.364	0.245	0.435	0.497	0.506	0.453
Observations	112517	92068	75958	86939	86829	82360	81138	80340	69980

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar. *January* indicates schools that start in January. *Jan. Sug. Instr.* is the SSIV constructed with January sugarcane prices and suitability for sugarcane production.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.1.4 Regional heterogeneity

Table A6: Dropout rate for primary schools in Central-West

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
Bartik Instr.	0.0864	-0.0639	-0.0800	0.224	0.252*	0.144	0.0580	0.141	0.296
	(0.0811)	(0.0878)	(0.135)	(0.125)	(0.123)	(0.123)	(0.117)	(0.136)	(0.191)
Mean Outcome	1.317	0.958	1.776	0.945	0.919	1.354	1.392	1.579	2.577
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.407	0.421	0.467	0.337	0.367	0.488	0.463	0.459	0.452
Observations	61069	53723	44000	50371	50682	47098	46725	45967	37672

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A7: Dropout rate for primary schools in Northeast

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
Bartik Instr.	-0.0557	0.0112	0.0902	-0.118	-0.0464	-0.0808	-0.123	-0.0921	-0.0925
	(0.0472)	(0.0502)	(0.0896)	(0.0621)	(0.0601)	(0.0633)	(0.0653)	(0.0696)	(0.103)
Mean Outcome	2.890	2.825	4.298	2.667	2.548	2.811	2.863	3.098	5.234
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.389	0.384	0.477	0.319	0.321	0.431	0.407	0.397	0.506
Observations	400430	411369	245206	376871	372536	306016	299343	285565	155417

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A8: Dropout rate for primary schools in North

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
Bartik Instr.	-0.0739	-0.156	0.147	-0.150	0.0158	0.163	0.0915	-0.150	-0.0194
	(0.132)	(0.130)	(0.239)	(0.171)	(0.174)	(0.168)	(0.187)	(0.206)	(0.314)
Mean Outcome	4.787	5.101	7.279	4.740	4.549	4.143	4.338	4.828	7.175
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.374	0.370	0.424	0.286	0.292	0.346	0.324	0.323	0.416
Observations	142929	154537	94948	141164	142347	117182	115418	112452	60321

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A9: Dropout rate for primary schools Southeast

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
Bartik Instr.	0.0490	0.0162	0.0166	0.0658	-0.0316	-0.00929	-0.0272	-0.00664	-0.00836
	(0.0395)	(0.0444)	(0.0677)	(0.0495)	(0.0438)	(0.0446)	(0.0537)	(0.0479)	(0.0774)
Mean Outcome	0.930	0.524	1.286	0.590	0.502	0.732	0.725	0.828	1.715
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.395	0.369	0.473	0.326	0.323	0.494	0.440	0.477	0.482
Observations	280228	242230	181437	229480	228892	205709	203486	201047	152496

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A10: Dropout rate for primary schools in South

	(1) Drop 1Y PR	(2) Drop 2Y PR	(3) Drop 3Y PR	(4) Drop 4Y PR	(5) Drop 5Y PR	(6) Drop 6Y PR	(7) Drop 7Y PR	(8) Drop 8Y PR	(9) Drop 9Y PR
Bartik Instr.	0.0337	0.00396	0.0817	0.0939**	0.0178	0.0216	0.0767	0.0649	0.0749
	(0.0291)	(0.0243)	(0.0630)	(0.0332)	(0.0317)	(0.0489)	(0.0427)	(0.0438)	(0.0710)
Mean Outcome	0.710	0.294	1.150	0.279	0.264	0.569	0.649	0.780	1.568
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.406	0.273	0.469	0.260	0.260	0.418	0.439	0.441	0.420
Observations	139695	123170	97007	119402	120309	109921	108408	105888	82627

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A11: Failure rate for primary schools in Central-West

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	-0.0957	0.398*	0.328	0.394*	0.448*	0.583*	0.506*	-0.0542	-0.325
	(0.112)	(0.174)	(0.264)	(0.164)	(0.181)	(0.262)	(0.229)	(0.218)	(0.259)
Mean Outcome	4.236	5.558	7.568	2.696	4.444	7.430	6.001	4.849	7.187
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.628	0.621	0.583	0.489	0.597	0.618	0.578	0.507	0.556
Observations	61069	53723	44000	50371	50682	47098	46725	45967	37672

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A12: Failure rate for primary schools in Northeast

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	-0.0858	-0.379***	0.0916	-0.109	-0.145	-0.0399	-0.0612	0.101	0.0269
	(0.0617)	(0.0782)	(0.132)	(0.0737)	(0.0795)	(0.114)	(0.110)	(0.121)	(0.129)
Mean Outcome	7.371	9.406	12.88	5.186	5.342	11.10	9.191	8.665	11.49
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.516	0.530	0.531	0.454	0.413	0.515	0.456	0.396	0.596
Observations	400430	411369	245206	376871	372536	306016	299343	285565	155417

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A13: Failure rate for primary schools in North

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	0.189	0.175	0.127	0.176	0.171	0.0354	0.408	0.122	-0.256
	(0.134)	(0.166)	(0.262)	(0.148)	(0.166)	(0.250)	(0.234)	(0.272)	(0.276)
Mean Outcome	8.718	13.05	13.09	5.323	6.105	12.47	11.14	10.62	9.952
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.455	0.516	0.454	0.411	0.372	0.419	0.412	0.371	0.448
Observations	142929	154537	94948	141164	142347	117182	115418	112452	60321

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A14: Failure rate for primary schools Southeast

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	0.0191	-0.148	0.279*	0.0950	0.0929	0.0693	0.0294	-0.184	-0.0576
	(0.0690)	(0.0935)	(0.133)	(0.0839)	(0.100)	(0.134)	(0.115)	(0.110)	(0.140)
Mean Outcome	4.080	3.962	7.521	2.424	3.143	6.042	4.001	3.858	7.557
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.604	0.585	0.616	0.481	0.490	0.604	0.593	0.507	0.593
Observations	280228	242230	181437	229480	228892	205709	203486	201047	152496

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A15: Failure rate for primary schools in South

	(1) Fail 1Y PR	(2) Fail 2Y PR	(3) Fail 3Y PR	(4) Fail 4Y PR	(5) Fail 5Y PR	(6) Fail 6Y PR	(7) Fail 7Y PR	(8) Fail 8Y PR	(9) Fail 9Y PR
Bartik Instr.	0.262***	0.377***	0.505***	0.204*	0.209*	0.459**	0.0814	-0.0866	0.0229
	(0.0694)	(0.0991)	(0.138)	(0.0814)	(0.0958)	(0.154)	(0.136)	(0.121)	(0.153)
Mean Outcome	5.163	5.875	9.603	2.371	3.802	9.066	6.687	5.964	10.48
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.642	0.558	0.581	0.452	0.487	0.552	0.552	0.518	0.597
Observations	139695	123170	97007	119402	120309	109921	108408	105888	82627

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.2 Effects for secondary schools

A.2.1 Main specification

Table A16: Dropout rate at secondary schools

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.390**	0.419**	0.293
	(0.148)	(0.155)	(0.159)
Mean Outcome	7.324	7.460	5.985
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
R-squared	0.713	0.670	0.632
Observations	237681	231054	225692

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A17: Failure rate at secondary schools

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
Bartik Instr.	-0.143	-0.108	-0.0538
	(0.177)	(0.195)	(0.169)
Mean Outcome	11.28	12.65	8.380
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
R-squared	0.680	0.648	0.579
Observations	237681	231054	225692

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.2.2 Controlling for local characteristics

Table A18: Dropout rate for secondary schools

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.483***	0.566***	0.539***
	(0.146)	(0.153)	(0.158)
Mean Outcome	7.371	7.523	6.037
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.721	0.678	0.637
Observations	214636	208572	203630

Notes: Robust standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A19: Failure rate for secondary schools

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
Bartik Instr.	-0.0103	0.0271	0.0581
	(0.173)	(0.191)	(0.173)
Mean Outcome	11.00	12.40	8.218
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.681	0.653	0.582
Observations	214636	208572	203630

Notes: Robust standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.2.3 Academic calendar

Table A20: Failure rate

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
January=1 × Jan. Sug. Instr.	1.359***	1.033***	0.973***
	(0.0608)	(0.0803)	(0.0615)
Jan. Sug. Instr.	-0.0635	0.308	0.385
	(0.354)	(0.393)	(0.340)
Mean	8.878	10.50	7.119
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.676	0.642	0.596
Observations	51937	50716	49882

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar. *January* indicates schools that start in January. *Jan. Sug. Instr.* is the SSIV constructed with January sugarcane prices and suitability for sugarcane production.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.2.4 Regional heterogeneity

Table A21: Dropout rate for secondary schools in Central-West

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	1.300**	0.983*	0.634
	(0.468)	(0.473)	(0.487)
Mean Outcome	6.218	6.462	5.086
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.659	0.625	0.608
Observations	17679	17019	16322

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A22: Dropout rate for secondary schools in Northeast

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.503	0.281	0.444
	(0.333)	(0.349)	(0.325)
Mean Outcome	9.169	9.291	7.213
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.696	0.655	0.611
Observations	48940	47158	45717

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A23: Dropout rate for secondary schools in North

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	1.148	1.173	1.389
	(0.622)	(0.708)	(0.786)
Mean Outcome	10.08	10.44	8.796
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.645	0.607	0.589
Observations	16873	15981	15460

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A24: Dropout rate for secondary schools Southeast

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.314	0.564**	0.218
	(0.161)	(0.174)	(0.163)
Mean Outcome	4.050	4.404	3.545
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.638	0.606	0.554
Observations	95595	93596	91926

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A25: Dropout rate for secondary schools in South

	(1) Drop 1Y HS	(2) Drop 2Y HS	(3) Drop 3Y HS
Bartik Instr.	0.676***	0.539**	0.393*
	(0.183)	(0.193)	(0.189)
Mean Outcome	6.280	6.445	5.260
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.639	0.621	0.566
Observations	35549	34818	34205

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A26: Failure rate for secondary schools in Central-West

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
Bartik Instr.	-1.810*	-2.148*	-1.598
	(0.765)	(0.982)	(0.840)
Mean Outcome	10.79	12.11	7.878
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.647	0.627	0.565
Observations	17679	17019	16322

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A27: Failure rate for secondary schools in Northeast

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
Bartik Instr.	-0.215	0.151	0.00614
	(0.263)	(0.294)	(0.301)
Mean Outcome	8.473	9.874	6.408
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.611	0.607	0.535
Observations	48940	47158	45717

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A28: Failure rate for secondary schools in North

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
Bartik Instr.	0.162	-0.251	-0.320
	(0.463)	(0.567)	(0.469)
Mean Outcome	7.939	9.215	6.699
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.601	0.577	0.526
Observations	16873	15981	15460

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A29: Failure rate for secondary schools Southeast

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
Bartik Instr.	0.222	0.275	0.392*
	(0.210)	(0.238)	(0.198)
Mean Outcome	8.347	9.779	6.210
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.626	0.596	0.527
Observations	95595	93596	91926

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A30: Failure rate for secondary schools in South

	(1) Fail 1Y HS	(2) Fail 2Y HS	(3) Fail 3Y HS
Bartik Instr.	0.0237	-0.0708	-0.0163
	(0.210)	(0.232)	(0.218)
Mean Outcome	11.12	13.00	8.030
School FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Municipality-Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-squared	0.683	0.657	0.575
Observations	35549	34818	34205

Notes: Robust standard errors in parentheses. The educational outcome is measured from 0 to 100, we report its mean. The point estimates indicate the percentage points change in the outcome rate given one standard deviation increase in SSIV. The controls are at the municipality level: share of males, share of residents in rural areas, share of family farms among agricultural establishments. The sample consists of all Brazilian schools reporting educational rates in Censo Escolar.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

B Figures

B.1 Suitability

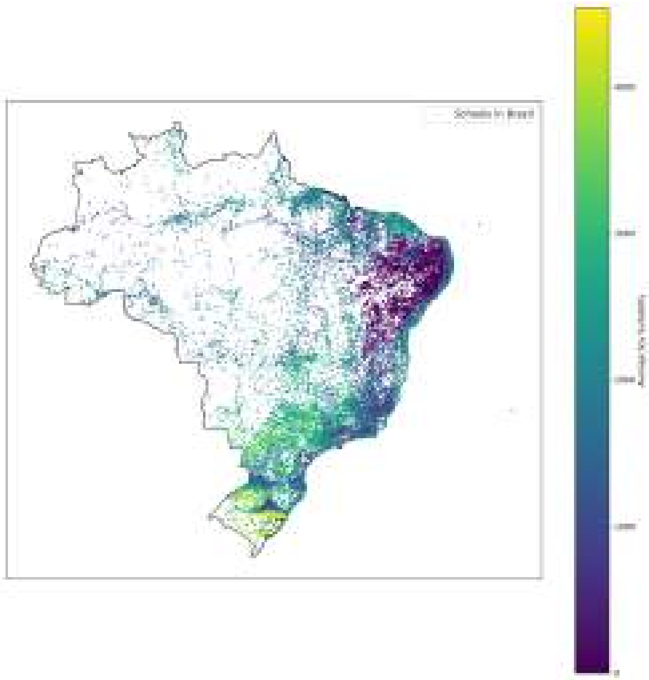

Figure B1: Schools by soy suitability

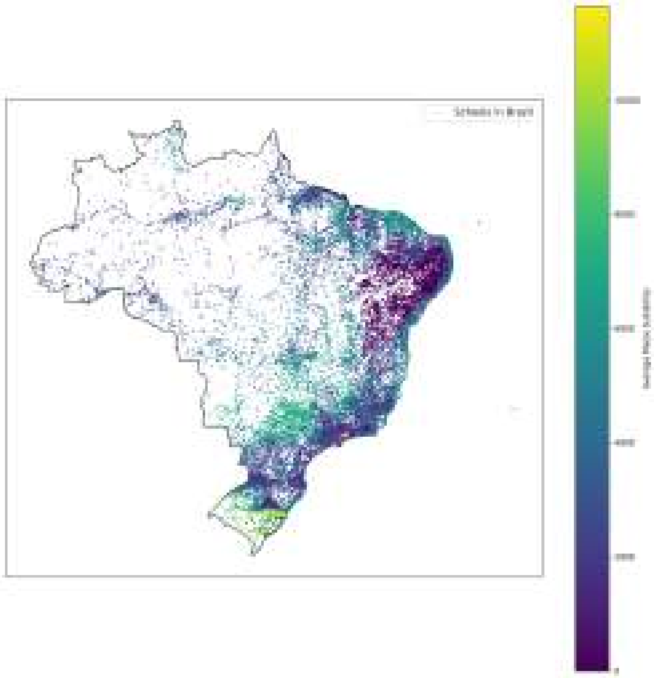

Figure B2: Schools by maize suitability

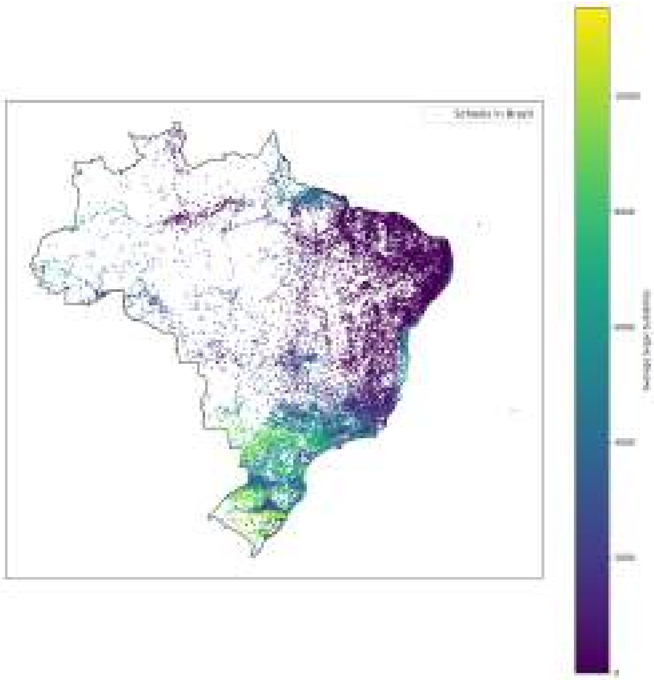

Figure B3: Schools by sugar suitability

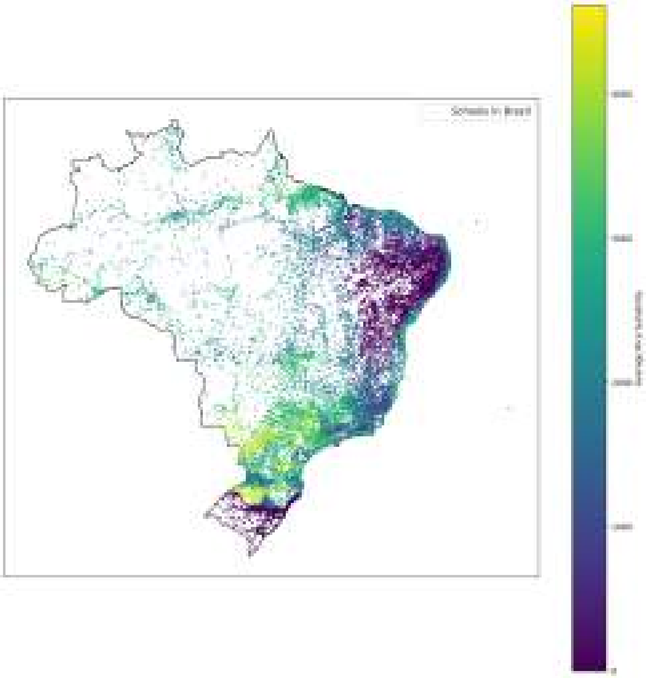

Figure B4: Schools by rice suitability

B.2 Agricultural production

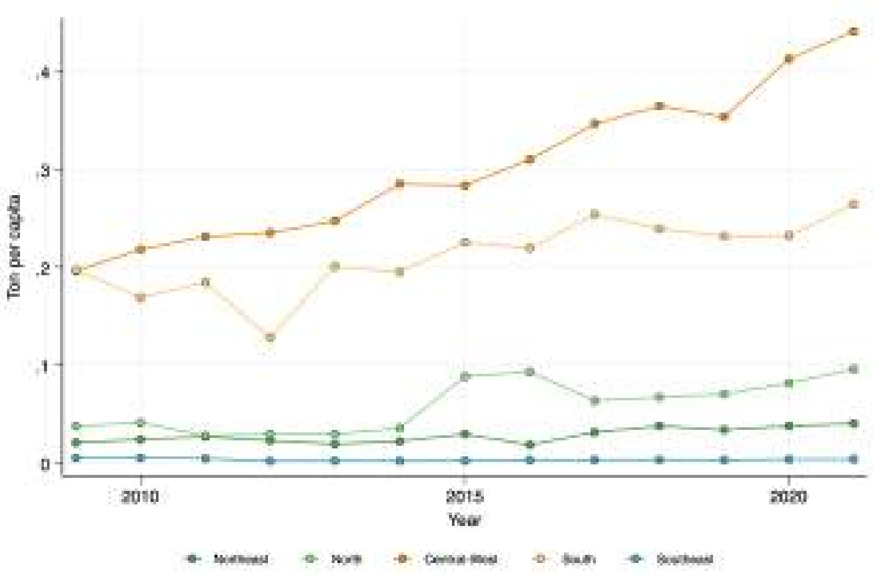

Figure B5: Soy production per capita

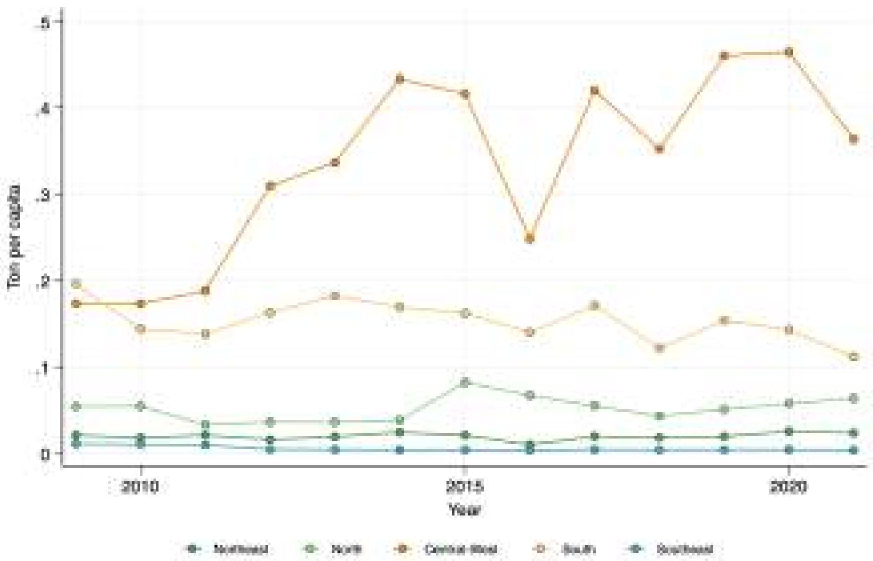

Figure B6: Maize production per capita

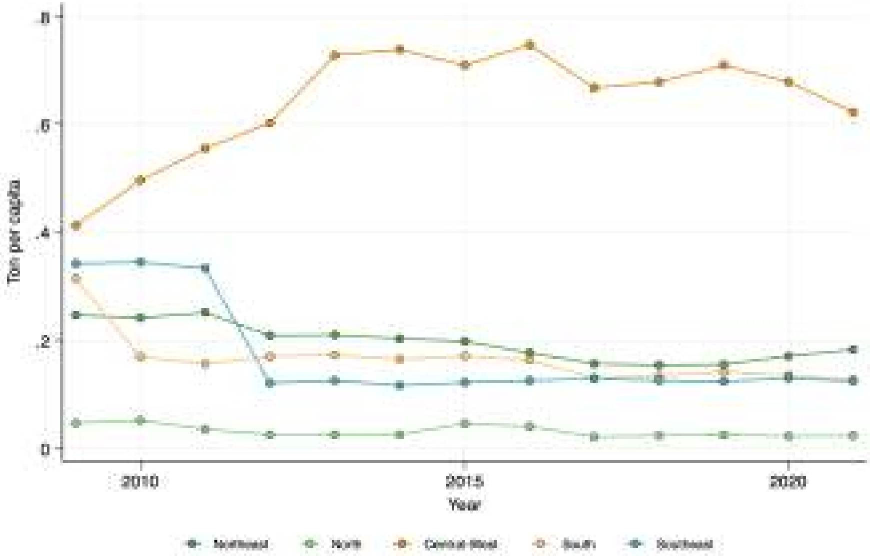

Figure B7: Sugar production per capita

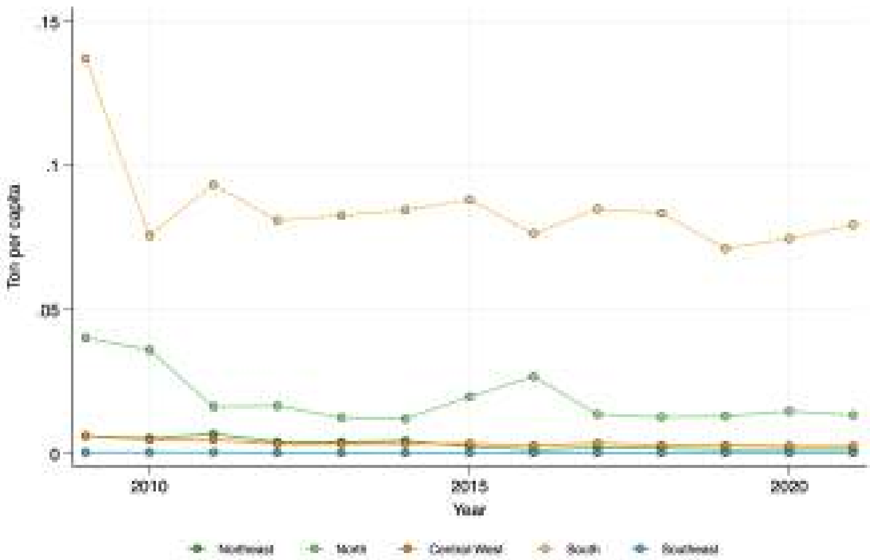

Figure B8: Rice production per capita

B.3 Controlling for local characteristics

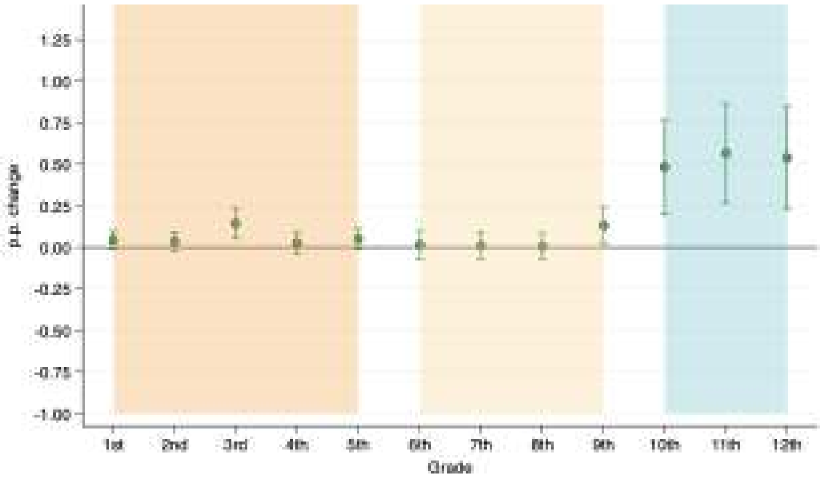

Figure B9: Dropout rate for primary and secondary schools

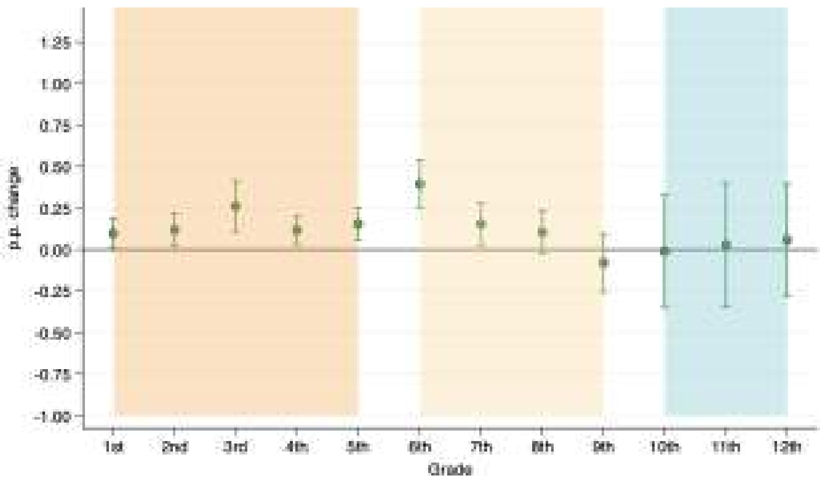

Figure B10: Failure rate for primary and secondary schools